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No.

In the

Supreme Court of the United States

OCTOBER TERM, 1981

SWIFT AGRICULTURAL CHEMICALS CORPORATION,

Petitioner,

vs.

FARMLAND INDUSTRIES, INC., ET AL.,

Respondents.

APPENDIX TO PETITION FOR A WRIT OF CERTIORARI TO THE UNITED STATES COURT OF APPEALS FOR THE TENTH CIRCUIT

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APPENDIX A

[1351] SWIFT AGRICULTURAL CHEMICALS CORPORATION, Delaware corporation,

Plaintiff-Appellant,

v.

FARMLAND INDUSTRIES, INC., a Kansas corporation and Farmers Chemical Company, a Kansas corporation,

Defendants-Appellees.

No. 80-2089.

United States Court of Appeals, Tenth Circuit.

March 25, 1982.

Patent holder brought action claiming that defendant wilfully infringed patent which pertained to production of liquid ammonium polyphosphate fertilizer from wet phosphoric acid. The United States District Court for the District of Kansas, Dale E. Saffels, J., 499 F.Supp. 1295, held that patent was invalid, and patent holder appealed. The Court of Appeals held that patent No. 3,464,808, was invalid as level of ordinary skill in area was sufficient that particulars of patent process were obvious at time of its creation.

Affirmed.

Patents — 328(2)

Patent No. 3,464,808, a process patent which pertained to production of liquid ammonium polyphosphate fertilizer from wet process phosphoric acid, was invalid as level of ordinary skill in area was sufficient so that particular patent process were obvious at time of its creation. 35 U.S.C.A. §§ 102, 103.

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Before HOLLOWAY and DOYLE, Circuit Judges, and KUNZIG.*

PER CURIAM.

The appeal herein is from a judgment entered by the United States District Court [1352] Judge of the District of Kansas which dismissed a complaint which charged patent infringement. This action was brought by Swift Agricultural Chemicals Corp. against Farmland Industries, Inc., the appellee herein, and Farmers Chemical Co., a subsidiary of the Farmland corporation. The charge was that Farmland willfully infringed the patent of Swift No. 3,464,808, which was referred to as the 808 or Kearns patent. This is a process patent which pertains to the production of liquid ammonium polyphosphate fertilizer from a wet process phosphoric acid.

The trial court ruled that the patent was invalid. The crucial question in the case is whether the trial court

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* Honorable Robert L. Kunzig Judge of the United States Court of Claims, sitting by designation.

The Honorable Robert L. Kunzig heard the oral arguments in the above entitled case. Unfortunately, however, subsequent to the arguments and before the within opinion was submitted to the panel, the Honorable Robert L. Kunzig passed away, on February 21, 1982. Thus, he did not vote on or participate in the within opinion. The remaining members of the panel have proceeded in accordance with 28 U.S.C. Section 46(d).

erred in its conclusion that the invention contained in the Kearns letter patent was invalid. A further contention is that the district court was in error in adjudicating invalid the claims other than those which were in issue. (There is a dispute as to whether these additional claims were in issue.) A third issue is whether the court erred in holding that Farmland avoided infringement based on its argument that (a) it used superphosphoric acid and (b) the residence time in the melt in its process is more than one second.

In support of its claim that the trial court reached out and adjudicated claims that were not in issue, it is pointed out that the post-trial submissions of Swift charged Farmland with willful infringement in claims 1, 2 and 4 only.

Our main concern is with the validity of the Kearns patent which discloses a method for making liquid ammonium polyphosphate fertilizer (referred to as APP.) The fertilizer contains substantial amounts of nitrogen and phosphorous, elements essential to plant nutrients. The fertilizers are often sold in solid granulated form. However, liquid fertilizers appear to be preferred because of the ease of application in soluble form and its ready availability to plants. But the liquid is not free of problems, as we will discuss.

APP, as the substance is commonly called, is ordinarily made by the combination of phosphoric acid with ammonia. What is referred to as the ordinary "wet process" or orthophosphoric[1] acid is low in phosphorus pentoxide. The formula for this is P_2O_5. It tends to contain substantial amounts of impurities which occur in the phosphate rock from which the acid is made. These impurities are

[1] The orthophosphoric acid form contains a significant amount of water hydrated to the acid. If the phosphoric acid is heated to drive off the water a point is reached where acyclic polymerization occurs. This form of the acid is best suited to holding impurities in solution.

ordinarily in the form of iron and aluminum compounds and they tend to precipitate out of solution when the orthophosphoric acid is combined with the neutralizer, ammonia. These are the substances which combine to make the product. Thus, the APP is inclined to have gelatinous sludge-like precipitates which renders its use difficult. It clogs the fertilizer application equipment.

For a long time efforts have been made to prevent the creation of this gelatinous sludge from forming during the APP manufacturing process. The common solution is to combine purified furnace grade or highly concentrated wet process superphosphoric acid. This is created by heating wet process acid until enough molecular dehydration has taken place. This is characterized by high P_2O_5 contents, 70% or more, and the presence of a substantial percentage of phosphates in the polymerized form. Those phosphates sequester impurities in solution and form stable compounds that do not precipitate out of solution when the acid is neutralized with ammonia. One of the weaknesses of this approach is its high cost. Ordinarily wet process orthophosphoric acid [1353] is cheaper and so most efforts have been directed at the development of a commercial process capable of producing APP from such acid. The Kearns patent, which dates back to 1969, at which time it was granted to Tommy Carter Kearns, a former Swift employee, undertakes to disclose one such process.

There is no dearth of prior art. All of the patents describe a method which seeks to use the ingredients so as to avoid the sludge problem.

Discussion of Kearns Patent

The Kearns patent, which is the patent in suit, describes the use of a pipe shaped jet reactor for the purpose of mixing or combining the wet process orthophosphoric acid with ammonia at a high temperature, 450 degrees to 650 degrees F. The period of time for combining is less than one second, followed by a quench-

ing with water to form a liquid APP fertilizer. Thus, the orthophosphoric acid utilized in this process contains 54%-68% P_2O_5. The process utilizes heat energy provided during the reaction for the purpose of simultaneously neutralizing and molecularly dehydrating the acid. At least 20% of the acids orthophosphates are converted to polyphosphates during the reaction and the resulting product has self-sequestered properties. The impurities present in the acid remain in solution in the APP instead of precipitating out in the form of gelatinous sludge.

This process has been employed by Swift since 1967. Its commercial success has not been extensive. The problems with the product limit its usefulness. Nevertheless, Swift has prevailed in at least one infringement action involving the Kearns patent. Its adversary was Usamex, Inc. *See Swift Chemical Co.* v. *Usamex Fertilizers Co., Inc.*, 197 U.S.Q. 10 (E.D.La. 1977) (Usamex I); *Swift Chemical Co.* v. *Usamex Fertilizers Co., Inc.*, 490 F.Supp. 1343 (E.D.La. 1980) (Usamex II), *aff'd*, 646 F.2d 1121 (5th Cir. 1981).

The time span in which the chemicals come together is disputed. Swift employs a steam residence[2] calculation for determining the mixing time of the acid and ammonia and, as noted, calculates residence time at less than one second. Farmland measures the time that the APP melt[3] itself remains in the reactor, resulting in a melt residence time greater than three seconds.

The length of the trial was approximately eight days. At its completion the trial court ruled in favor of the defendants, concluding that the Kearns patent was neither valid nor infringed by Farmland. The opinion of the district judge is reported at 499 F.Supp. 1295 (D.Kan. 1980).

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[2] For an explanation of the steam residence calculation see *infra* pp. 1357-1358.

[3] The "melt" is the product formed where the ammonia and phosphoric acid combine.

On the subject of validity, the ruling of the trial court was that the patent was anticipated by prior art and that it was obvious. Before issuance of the Kearns patent several other inventors had patented or applied for patents in processes similar to the 808 patent. The court focused in particular on methods developed by Young, Getsinger and Lutz and Rubio.

The trial court also ruled that even if the Kearns patent were valid, the Farmland process did not infringe upon it because the process used by Farmland utilized superphosphoric acid (68% P_2O_5) instead of the wet process orthophosphoric acid 54%-60% P_2O_5 which was called for by the Kearns patent. Further, the court continued, the doctrine of file wrapper estoppel was capable of preventing Swift from claiming that a process involving superphosphoric acid infringed upon the Kearns process.

During patent prosecution Kearns had represented to the patent office that the process was distinguishable from the prior art because it utilized ordinary phosphoric rather than superphosphoric acid. To be noted is the fact that the Farmland process entails a residence time of more than one second. The court found Farmland's melt residence method for calcuating residence [1354] time scientifically more valid than Swift's steam residence formula. Based on this difference there was no showing of infringement.

Swift has advanced five prior art processes which it seeks to distinguish from the Kearns method; these include the following: 1) Young, U.S. patent No. 3,044,851; 2) Lutz and Rubio, Patent Application Serial Number 352,764; 3) Hignett, U.S. Patent No. 3,171,733; 4) Bookey, U.S. Patent No. 3,375,063; and 5) Getsinger, U.S. Patent No. 3,382,059. These are briefly described below.

The two most relevant inventions to our inquiry are the Young patent and the Lutz and Rubio application. The latter failed to receive a patent; the patent office

declared and interference and awarded the patent to Bookey. *Lutz* v. *Bookey*, 170 U.S.P.Q. 594 (Patent Board of Interference 1971).

The Young Patent, filed 6/9/61, *patented* 7/17/62

In February 1957 Dr. Young, a chemist with a Ph.D., was employed by the Union Oil Company. He had entered with a good many inventions to his credit. He personally made a sketch of APP reactor apparatus, which was in fact built and operated. This sketch depicts a continuous tubular pipe apparatus and method wherein ammonia and preheated merchant grade phosphoric acid are simultaneously injected into the pipe and produce APP by a simultaneous neutralization and molecular dehydration reaction; self-sequestering APP melt is then quenched with water to yield a self-sequestering liquid fertilizer product. In the Young process wet phosphoric acid is first heated in a pressurized tank to dehydrate and concentrate it. The acid is then cooled and reacted with ammonia to produce a self-sequestering liquid fertilizer.

The trial court found and concluded that the Young method anticipated the current patent even with Young's recital of two steps instead of only one, because the nature of Young's method was fundamentally the same as that of Kearns. The lower court found further that using Swift's method of calculating residence time the Young process established a residence time of less than one second.

The Young patent heats the wet process acid (35-55% P_2O_5) prior to the addition of ammonia. The introduction of ammonia can be brought about either during or after the heating process. If ammonia is added during the heating, it is a one step process because the exothermic heat of reaction further concentrates the acid; if added after, it is two steps. The heated acid is concentrated so that up to 40% of the acid is in the acyclic polyphosphate form. This heating drives off water and volatile impurities.

The patent was summarized by the trial court as follows:

> "5. The Young patent, 3,044,851, discloses a process that is materially identical to that described in the Kearns patent in suit, No. 3,464,808, in that it discloses a continuous reaction between phosphoric acid and ammonia, in a tubular reactor, at a temperature of between 450 degrees F. and 650 degrees F., with a residence time of less than one second, involving simultaneous neutralization and molecular dehydration, and producing an ammonium polyphosphate fertilizer bearing self-sequestering properties."

Getsinger filed 7/2/64, *patented* 5/7/68.

The trial court considered the Getsinger process to be "materially identical" to Kearns. Getsinger uses wet process acid with a P_2O_5 content of between 30-54%. The acid is put in a scruber vessel and partially neutralized with ammonia at a temperature between 250-350 degrees F. Then the partially neutralized product is led into a reactor where more ammonia is added to form the ammonium polyphosphate melt. In the reactor the temperature is between 400-500 degrees F. The court found simultaneous neutralization and mo- [1355] lecular dehydration of the acid occurs in a reaction vessel (No. 6) of the Getsinger patent where the appropriate pressures are present. The trial judge did not consider it a significant difference that the Getsinger patent requires a tank instead of a reactor pipe since the method and not the equipment is the crux of a process patent. The specifications recite that the Getsinger process involves "the ammoniation of wet process phosphoric acid."

Lutz and Rubio Patent Application, filed 6/9/61.

The court made a factual finding that the Lutz and Rubio process describes a continuous reaction between phosphoric acid and ammonia in a tubular reactor, at a temperature of between 450 and 650 degrees F., with a

residence time of less than one second, involving simultaneous neutralization and molecular dehydration and producing an ammonium polyphosphate fertilizer bearing self-sequestering properties. The patent application states that approximately 40% non-ortho APP can be produced by injecting respective streams of phosphoric acid (50%-58%) P_2O_5 and ammonia into the pipe and causing a simultaneous neutralization and molecular dehydration reaction to occur at temperatures of 400-500 degrees F. The contact time for the Lutz process was determined to be well below one second. Lutz had testified that the residence time of his invention, calculated by the use of the Swift formula, was on the order of .01 seconds.

The Lutz application states "tests were in a pipe reactor under various conditions whereby concentrated wet process orthophosphoric acid and anhydrous ammonia were contacted directly for the purpose of producing a concentrated ammonium polyphosphate product."

The trial court concluded that the Lutz process was virtually identical to the Kearns process, citing additional evidence that the residence time was less than one second. The trial court also held that even if the prior art did not literally anticipate the Kearns patent, that the patent was nevertheless invalid because the process it disclosed was obvious to anyone with ordinary skill in the art. The court also found that the prior art included descriptions of all of the elements important to the Kearns process, such as the use of a pipe or jet reactor, high temperature ranges and short residence times. The difference between the prior art and the Kearns patent according to the court amounted only to minor distinctions about recommended equipment. Also, the end product in the Lutz effort was dry material, which, of course, is of no consequence since a soluble APP melt can be produced by the introduction of water at the appropriate stage.

Hignett, filed 9/8/61, patented 3/2/65.

72%-85% or "super H_3PO_4 (electric furnace acid) or wet process of 65% 75% is used. Apparently, the process is marked by no pre-heating. This has been called a three-step process. First, there is employed a reactor vessel, then a solidification and granulation chamber is used, then cooling equipment and finally through a screen. The Hignett process has an agitator in the reactor vessel. Though the Hignett process has general similarity to the Swift process, it is much less similar than the methods of Young, Getsinger and Lutz and Rubio.

Bookey filed 2/23/64, patented 3/26/68.

The Bookey patent begins with wet process acid with a P_2O_5 content between 45-60%. A vertical column or tank type reactor is employed. There is simultaneous concentration of the orthophosphoric acid to the nonortho form along with dehydration and ammoniation. Temperature in the reaction is between 338 degrees to 482 degrees F. When a vessel is used agitation is to occur. A residence time of one hour was utilized in one of the patent's examples.

The Issue of Unpatentability Due to Obviousness.

The view that we take, namely that this patent was unpatentable because of obviousness, renders it unnecessary for us to [1356] consider in detail the issue of infringement. We approve the district court's ruling on this question. The court's findings are not clearly erroneous. We agree as well with its conclusion as to anticipation in the prior art. Our view of the case is that the patent is invalid; furthermore we are of the opinion that the patent is void due to obviousness. This latter issue we consider to be entitled to the emphasis in this opinion. Accordingly, the patent is contrary to 35 U.S.C. § 102 and is obvious within the terms of 35 U.S.C. § 103.

The Supreme Court noted in its landmark decision in *Graham* v. *John Deere Co.*, 383 U.S. 1, 17, 86 S.Ct. 684, 693, 15 L.Ed.2d 545 (1966) that "manifestly, the validity of each of these patents turn on the facts". *Id.* at 5, 86 S.Ct. at 687. The Court in Graham observed that § 103 and matters contained in it had been recognized by the cases long prior to the adoption of the section and that § 103 was a codification of the requirement of non-obviousness. The 1851 decision of the Supreme Court in *Hotchkiss* v. *Greenwood*, 11 How. 248, 13 L.Ed. 683, recognized this when it said that there had to be more ingenuity and skill than that possessed by an ordinary mechanic acquainted with the business. The decision recognized the distintcion between new and useful inovations capable of sustaining a patent and those that failed to meet this standard. When § 103 was enacted non-obviousness became an added statutory condition of patentability. The Court's opinion in *Graham* termed non-obviousness a more practical test of patentability. The procedure under § 103 of the Act for determining patentabiilty was considered by the Supreme Court in *Graham, supra*, 383 U.S. at page 17, 86 S.Ct. at page 693:

> Under § 103, the scope and content of the prior art has to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt and unsolved needs, failure of others, etc. might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy. See Note, Subtests of Nonobviousness: A Non-technical Approach to Patent Validity, 112 U. of Pa.L.Rev. 1169 (1964).

Thus, when a process or device is not identically disclosed in the prior art, but would be obvious to a worker of ordinary skill in the field at the time the invention was made, then § 103 is not satisfied. *True Temper Corp. v. C.F. & I Steel Corp.*, 601 F.2d 495 (10th Cir. 1979). In *Graham* the challenged device had a spring clamp which allowed plow shanks to be pushed upward when an obstruction was encountered in the soil. Thus, the upward push was reversed and the shank returned to its normal position. It was held that it failed to pass the test of non-obviousness. The device was held by the Supreme Court to be invalid becausse it did not meet the tests set forth in § 103.

Further Analysis of Kearns in Light of Prior Art

We turn now to consideration of the Kearns patent and a comparison of that with the relevant prior art.

The district court found the Kearns process to be a combination patent, synthesizing known elements to get an improved result.

Creation of liquid ammonium polyphosphate fertilizer from phosphoric acid and ammonia is not a new idea. The novelty that Kearns claims is the use of merchant grade wet process acid, a cheaper acid less pure than the "electric furnace" acid which contains virtually no metal impurities, in combination with liquid or gaseous ammonia to simultaneously concentrate and dehydrate the acid, while ammoniating it to produce the APP melt that becomes the aqueous fertilizer. Although we have examined a number of variables in each of the prior processes in the Kerns patent, the crucial [1357] elements of comparison are 1) the type of acid used, 2) whether there is a simultaneous concentration of the acid creating a substantial non-orthophosphate formation along with dehydration and ammoniation, 3) the temperature of the reaction, 4) the mixing time in the reactor (residence time) and 5) the percentage of non-orthophosphate in the end product melt.

The type of phosphoric acid which Kearns begins with was known to the prior art. In fact, of the five processes we have mentioned, only the Hignett method advocates starting with a "superphosphoric" acid made by the electric furnace method that has a phosphorus content, expressed in terms of phosphorus pentoxide (P_2O_5), between 72% and 85%. This is highly concentrated acid; it is already dehydrated to such an extent that a substantial amount of the acid is in the polyphosphate form before contacting the ammonia. The remaining methods teach that wet process acid with P_2O_5 percentages between 30 and 60% may be used. Even the Hignett method permits the use of wet process acid if it is concentrated between 65 and 75% P_2O_5.

The Swift Company in using Kearns' process frequently makes use of wet process acid nearer the low end of the Kearns P_2O_5 range of 54%-68%. The crucial step in the Kearns process of reacting the acid ammonia to produce the concentrated polyphosphate acid wtihout first dehydrating the acid alone is not unique in the Kearns patent. Of the prior art, only Hignett and Young start with sufficiently concentrated acid to obviate the need for simultaneously ammoniating and cretaing a substantial amount of polyphosphates. As to Young, however, his process can be performed so that the ammonia is added during or immediately after the heating of the acid, allowing the exothermic heat of reaction to further concentrate the acid.

Kearns requires that the ammonia and phosphoric acid combine at a temperature of between 450 degrees and 650 degrees F. Since no heat is added to the reaction, apparently the temperature is controlled by the pressure, volume and molarity of the reactants.

The Lutz and Rubio application prefers a reaction temperature of 400-500 degrees F. Getsinger, although he teaches a two-step approach, combines the partially neutralized acid with more ammonia at a temperature between 300-600 degrees F.

The mixing time or residence time among the various methods was emphasized by the trial court. There appears to be a significant amount of confusion over its definition and its value in determining validity and infringement.

Kearns gives a residence tiem of less than one second in claim one of the patent. Kearns equates residence time with the time that the steam is in residence. In a deposition entered into evidence at trial Kearns explained that residence time is a mathematical calculation to estimate the amount of mixing time that transpires during the reactants' high speed exothermic propulsion through the reactor pipe. Farmland calculates a longer residence time. However, Young and Lutz-Rubio have a residence time comparable to that of Kearns using the Kearns calculation method.

Final Analysis

From a consideration of the Kearns patent in relation to the others, we have concluded that Kearns' use of residence time is no more than a descriptive analysis of what goes on when the ammonia and acid are allowed to mix at one end of the pipe to create the melt and steam, and then uninhibitedly flow out the other end of the reactor along with any unreacted ammonia. The parties and the lower court considered very significant the different methods of measuring residence time, depending on whether the assumption was made that the melt separates from the steam within the pipe, and moves at a different speed, or instead, the APP melt is entrained in the steam generated by the reaction and both melt and steam move at the same speed. Kearns assumed that the melt was entrained in the steam, both moving at the same speed. He calculated the residence time by adding the total volume per unit of [1358] time of steam, free ammonia and melt and then dividing by the volume of the reactor. Kearns did not measure the mixing time empirically. There seems to be some evidence that the

Kearns hypothesis is incorrect. However, it doesn't matter in considering the present problem. How the process works is of importance. Whether the inventor knows the theory is unimportant.

Deposition evidence at trial was that, based on Kearns' method of calculating residence time, Young, Getsinger and Lutz came up with a figure not greatly dissimilar to the Kearns calculation. Apart from this restrospective use of Kearns' residence time formula, the record contains a memo dated February 11, 1964 prepared at Dorr-Oliver, Inc., Lutz's employer, where a pipe reactor test for APP melt occurred using a residence time of a fraction of a second. Because the pipe reactor of the Kearns process involves a "plug flow" wherein the reactants are headed in the same direction, and the Kearns patent does not teach any mechanically induced mixing, agitation or hindering the melt from leaving the pipe of its own accord, then, at least as to the Young and Lutz processes, their residence measurements appear credible, for both of these prior methods use similar pipe reactors, temperature ranges, and types of acid.

We finally consider the ability to sequester or hold in suspension, the impurities present in the wet process acid. This is a crucial feature to the successful storage and application of APP fertilizer. The sequestration is best accomplished when the phosphoric acid is dehydrated to the point where acyclic polyphosphate formation occurs. The wet process acid is almost exclusively orthophosphate when manufactured. Kearns claimed that his process would achieve at least a twenty percent conversion of the phosphate in the melt product to the non-orthophosphate form. The prior art evidenced by Hignett, Getsinger, Young and Bookey contains this desired sequestration ability and the required polyphosphate formation is well known. The Young patent and the Lutz and Rubio application, the most similar processes

to the Kearns method, teach that their processes will yield as much as forty percent orthophosphate conversion.

Under the *Graham* discussion, we have examined the content of the prior art and the Kearns patent and made the crucial comparisons. We find, as did the district court, that considering the overlap among the prior art, the gaps where Kearns has altered the prior art in some fresh way are few and insignificant to the end product of self-sequestering APP fertilizer. We agree with the district court that because of the similarity between the prior art and the Kearns patent and the extensive research in this area, the level of ordinary skill in this area was sufficient so that the particulars of the Kearns process were obvious at the time of its creation.

Our mode of analysis here should not call into question the clearly erroneous standard of review involved. We have not tried this case de novo on appeal, for such is not our mission. *Halliburton* v. *Dow Chemical Co.*, 514 F.2d 377 (10th Cir. 1975). We have, however, looked at the evidence and have found nothing clearly erroneous in the lower court's application of the *Graham* approach to the nonobviousness issue.

Swift complains that the district court erred in holding the entire Kearns patent invalid and it should have limited its ruling to claims one, two and four, those that were dealt with in the post-trial submissions of the parties. This issue is without merit. Farmland's answer brought up the defense of the patent's invalidity. There is nothing to show that the validity of the entire patent was not at issue, therefore. Moreover, the other four claims in the patent, 3, 5, 6 and 7 are dependent on the others, and particularly on claims 1 and 2, and could not stand alone as patentable processes.

Our conclusion differs from that of Judge Sear in the two *Usamex Fertilizer* opinions. The Lutz and Rubio application was not before Judge Sear. Furthermore, our function in reviewing the non-obvious determination of the lower court is to apply the extremely limited clearly erroneous standard. [1359] We have found that the district court acted without error. We have previously noted our approval of the trial court's decisions on the invalidity based on prior anticipation together with the infringement issue. We have expressed our preference to emphasize the obviousness issue and at the same time we have expressed our approval of the infringement and anticipation issues as they were decided by the district court.

The judgment of the district court is affirmed.

APPENDIX B

499 F. Supp. 1295

[1295] SWIFT AGRICULTURAL CHEMICALS CORPORATION, A Delaware Corporation, Plaintiff,

v.

FARMLAND INDUSTRIES, INC., A Kansas Corporation, and Farmers Chemical Company, A Kansas Corporation, Defendants,

Civ. A. No. 78-4153.

United States District Court, D. Kansas.

Sept. 15, 1980.

[1296] MEMORANDUM & ORDER

SAFFELS, District Judge.

This is a patent infringement action brought pursuant to the Patent Statute, 35 U.S.C. § 1, *et seq.* Plaintiff in this action, Swift Agricultural Chemicals Corporation (hereafter Swift) owns a patent for a process in which:

> "Phosphoric acid having P_2O_5 content of between about 55%-65% is reacted with ammonia under conditions that simultaneously neutralize and molecularly dehydrate the acid whereby at least 20% of the orthophosphate is converted to non-orthophosphate (polyphosphate) and the resulting ammonium polyphosphate possesses self-sequestering properties."[1]

The process, officially designated as U. S. Letters Patent No. 3,464,808, was invented by one Tommy Carter

[1] Plaintiff's Exhibit No. 1, Kearns Patent, Col. 1, ll. 13-19.

Kearns, a former employee of Swift, and will be referred to as the '808 or Kearns patent. The patent was acquired on September 2, 1969. A detailed technical explanation of the background of this case is not necessary here, but a brief discussion will perhaps be useful. Agriculturally rich nations, such as the United States and Canada, generally make such intensive use of their tillable land that the essential plant nutrients found in the soil are steadily depleted. Less well-endowed countries, on the other hand, face the problem of growing crops for consumption or export upon land that is either less fertile or less extensive than that possessed by their more fortunate neighbors. One important consequence of this situation is an increased demand for synthetic fertilizers. Such fertilizers may be in either solid or liquid form, and, in addition to their obvious advantages, tend to share certain negative characteristics. These include a high cost of manufacture (traditionally attributed to the necessity of using top-grade phosphoric acid in the manufacturing process), as well as a certain difficulty in application, caused by the tendency of chemical impurities present in the fertilizer to precipitate into a gelatinous sludge that clogs [1297] storage tanks and applicator nozzles. The process embodied in the '808 patent is an attempt to resolve the problems usually attendant to the manufacture of synthetic fertilizer, since it is designed to produce in a relatively inexpensive manner a rich product bearing the capacity to hold in suspension, or sequester, those chemical impurities which would otherwise coagulate to make application more difficult. Plaintiff claims that defendants have infringed the '808 or Kearns patent by the unauthorized use of the process described in the patent.

This action was tried to the Court, following extensive discovery by both parties. The parties introduced a very large number of documents into evidence. The case involves only two essential questions: whether the patent is valid; and, if so, whether it has been infringed. These questions, along with related issues, are discussed below.

Findings of Fact and Conclusions of Law are separately stated.

I. *THE VALIDITY OF THE KEARNS PATENT*

A. *ANTICIPATION BY PRIOR ART*

Defendants have attacked the validity of the '808 patent on the ground that it was anticipated by prior art. Defendants have drawn attention to the fact that the Kearns patent is a process patent, one in which certain materials are dealt with in a particular manner in order to produce a special result. It is generally recognized that the patentability of a method or process claim "must rest on the method steps recited, not on the structure used, unless that structure affects the method steps." *Leesona Corp.* v. *United States*, 530 F.2d 896, 208 Ct.Cl. 871 (1976). *See also, Chemical Construction Corp.* v. *Jones & Laughlin Steel Corp.*, 311 F.2d 367 (3rd Cir. 1962).

Defendants argue that plaintiff's patent has been anticipated in at least three separate instances. The first such instance involves a patent acquired by one Donald C. Young, U. S. Patent No. 3,044,851, on July 17, 1962. Plaintiff distinguishes the Young and Kearns patents by characterizing the former as a "three-step process" as compared with the "single-step" taught by the Kearns patent. The evidence, however, does not suggest that such a distinction is meaningful. Both processes produce an ammonium phosphate fertilizer having self-sequestering properties. Both do so by reacting ammonia and phosphoric acid for comparable time periods and at comparable temperatures. Similar reactor vessels may be used. The only literal difference between the two processes is that the Young patent speaks of separate heating and neutralization steps, while the Kearns patent describes a process in which both steps occur simultaneously. The Court concludes that this variance between the processes does not mean that the Kearns and Young patents have presented different "methods" to produce

the same end. And, as has been previously noted, where process patents are concerned, the nature of the method involved is the crucial factor. Moreover, as defendants have demonstrated, the Young patent teaches "on its face" a simultaneous process, as shown in Figure 8 of the patent.[2] In short, the Young patent must be regarded as anticipatory prior art with regard to the Kearns patent.

Defendants also argue that the Kearns patent was anticipated by the work of J. G. Getsinger, U. S. Patent No. 3,382,059.[3] Getsinger acquired his patent on May 7, 1968. Plaintiff contends that any comparison between the Kearns and Getsinger patents is inapposite. In particular, plaintiff attempts to distinguish the two processes by alluding to the fact that the Getsinger patent provides for the use of two vessels rather than just one. Further, plaintiff asserts that the vessel in which the pertinent reaction takes place is not a "jet reactor" as called for in the Kearns patent. Finally, plaintiff states that the Kearns patent is markedly different from that of Getsinger, on the theory that the residence time of the latter process is much longer than that of the former. [1298] The Getsinger patent discloses a process for the production of ammonium polyphosphates from wet process phosphoric acid, in which the phosphoric acid is first partially ammoniated at low temperature (250°-350° F) and then fed to a reactor, where it is reacted with a stream of ammonia to form an ammonium polyphosphate melt. The streams of partially neutralized phosphoric acid and ammonia are contacted in reactor vessel No. 6 of the patent, at a preferred temperature of 400°-500° F.

As we have previously discussed, an attempt to distinguish these processes on the ground that the Getsinger

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[2] Defendants' Exhibit A-3, Young Patent, Col. 13, ll. 28-56.

[3] Defendants' Exhibit C-3.

patent contemplates a "tank" rather than a "jet" reactor is not a cognizable defense of patentability, since "method" rather than equipment is of crucial importance in a process patent. *Leesona Corp.* v. *United States, supra.* And simply because reactor vessel No. 6 is not necessarily depicted as a "pipe" or "jet" reactor does not mean that such a device would be unsuitable to the Getsinger invention, since the claims of a patent generally are not strictly limited to a device described in the specifications or depicted in a drawing. *Arnold Pipe Rentals Co.* v. *Engineering Enterprises, Inc.*, 350 F.2d 885 (5th Cir. 1965); *Ziegler* v. *Phillips Petroleum Co.*, 483 F.2d 358 (5th Cir. 1973).

The fact that the Getsinger patent utilizes two vessels is likewise of negligible importance. This so because the essence of the patent is found in the chemical reaction which takes place in reactor vessel No. 6. The Getsinger patent involves a continuous process, the nature and final product of which are the same as those in the '808 patent. The evidence indicates that the same simultaneous neutralization and molecular dehydration of the acid which is crucial to the '808 patent occurs in reactor vessel No. 6 of the Getsinger patent, since that vessel is the only place where the appropriate temperatures and pressures are present. Furthermore, an ammonium polyphosphate solution with self-sequestering properties is the product of both processes.

A third area of dispute between the parties as to the Getsinger patent concerns the residence time attributable to the process. The Getsinger patent states that the "retention" time of the process is from one (1) to one hundred eighty (180) minutes.[4] Since the Kearns patent calls for a residence time of less than one (1) second, it would seem clear that there could have been no anticipation of Kearns by Getsinger. The Getsinger patent, however, defines "retention" time in terms of the period

[4] *Id.*, at Col. 10, 11. 73-75.

during which the melt remains in the reactor.[5] Plaintiff argues that Getsinger's representations as to the "retention" time are conclusive on the point. Defendants, however, have approached the problem in a different manner. A central question in this lawsuit, on the issue of infringement, is the residence time of defendants' process. Plaintiff has defined "residence" (or "contact") time as follows:

> ". . . The 'period' referred to in Claim 1 of the patent is the average time during which the reaction product, consisting of molten ammonium polyphosphate, superheated steam and unreacted ammonia, is in the reactor at temperatures of between about 450° F. and about 650° F."[6]

Plaintiff calculates this time period in the following manner:

> ". . . The internal volume of the reactor pipe is ascertained, the volumes per second of the reaction product, principally steam and melt, are determined, and the former is divided by the latter to give the residence time."[7]

In analyzing that work which they consider to have been anticipatory of the Kearns patent, defendants have utilized the formula advanced by plaintiff to calculate respective residence times. Plaintiff has strenuously resisted this procedure on the theory that defendants may not read into the prior art the teaching of the Kearns [1299] patent. *Graham* v. *John Deere Co.*, 383 U.S. 1, 36, 86 S.Ct. 684, 703, 15 L.Ed.2d 545 (1966). Plaintiff contends that crucial elements such as a method for cal-

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[5] *Id.;* deposition of J. G. Getsinger, Defendants' Exhibit M, Vol. II, pp. 22-23, and Vol. I, p. 50.

[6] Defendants' Exhibit T-21, Answer to Interrogatory No. 25.

[7] Defendants' Exhibit U-21, p. 3.

culating residence time must come only from the "four corners" of the patent itself. If that were the case, however, there would have been no way to calculate residence time for any of the patents in question, including the patent in suit, since none of the patents disclose a formula for measuring residence time. These patents "teach" matters such as a method for determining residence time only in the sense that scientists, engineers and patent attorneys, possessed of certain skills relative to mathematics, chemistry and physics, are able to reason abstractly from other information given in the patent to make the desired computations. If the evidence in this case has shown anything, it is that although the fundamental physical laws are immutable for both plaintiff and defendants, the assumptions upon which calculations derived from those laws are based vary widely.

Given the fact that the prior art patents in this case do not contain specific formulae for the derivation of residence time, and in view of the fact that several viable methods, based upon different assumptions, may exist for making such a calculation, it is not unreasonable, for purposes of comparison, for defendants to analyze the prior art in terms of the theory of residence time advanced by plaintiff.

Using plaintiff's formula, D. C. Young measured the residence time of his patent, No. 3,044,851, and found that period to be less than one second, corresponding to the residence time claimed in the Kearns patent. Young's conclusion was based upon actual test records, as well as data from the patent itself, and plaintiff has not questioned the genuineness of Young's figures. However, plaintiff does criticize the use of its formula in connection with the analysis of the Getsinger patent, on the ground that the physical distinctions between the processes make the application of the Swift formula inappropriate in this case.

Our previous comments regarding the alleged distinctions between the Kearns and Getsinger patents should

make it clear that we consider defendants' approach to this problem to be entirely appropriate. The residence time of the Getsinger patent, using plaintiff's formula, is less than one second. This being the case, and taking into account the fact that there are no other reasonable bases for distinguishing the two patents, it is our conclusion that the Kearns patent was also anticipated by the Getsinger patent.

Defendants' argument regarding anticipation refers finally to a patent application entitled "Production of Ammonium Phosphate," Serial No. 352,764, filed on March 18, 1964, by William A. Lutz and Manuel J. Rubio (hereafter referred to as the Lutz application). The process described in the Lutz application is virtually identical to the one found in the Kearns patent. And in deposition and affidavit, Mr. Lutz has testified that the residence time of his invention, calculated with the use of the Swift formula, is on the order of .01 seconds.[8] Plaintiff contests the relevance of the Lutz application to this case on two grounds. Plaintiff first states that Lutz is irrelevant here because the residence time was calculated with the Swift formula. We believe that our previous analysis of this point disposes of that argument. Plaintiff's second contention regarding Lutz is that it may not be relied upon here because the application was abandoned following an interference proceeding in which priority was awarded to the Bookey, *et al.*, patent, No. 3,375,003. The Lutz application, however, was filed in March, 1964, and was not abandoned until 1971.[9] The relevant portion of the patent statute, 35 U.S.C. § 102(g), states in part:

"A person shall be entitled to a patent unless—

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[8] Defendants' Exhibit A, B-1 and C-1.

[9] Defendants' Exhibit X-22.

> "(g) before the applicant's invention thereof the invention was made in this country by another who had not abandoned, suppressed, or concealed it. . . ."

[1300] This language has been interpreted to mean that an abandonment is irrelevant unless it occurred "before the applicant's invention." *Allen* v. *W. H. Brady Co.*, 508 F.2d 64, 67 (7th Cir. 1974). In this case, it is clear that the abandonment of the Lutz application did not occur until after the Kearns process was patented. When this fact is considered in conjunction with the technical similarities which characterize the Lutz application and the Kearns patent, it is indeed reasonable to conclude that the Lutz application constituted anticipatory prior art with regard to the Kearns patent.

B. *OBVIOUSNESS*

If it is assumed, in spite of the foregoing discussion, that the Kearns patent is vital enough to withstand an attack on its validity based upon the concept of anticipation, the patent must still contend with the doctrine of obviousness. The pertinent section of the patent statute, 35 U.S.C. § 103, states in part as follows:

> "A patent may not be obtained . . . if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. . . ."

Defendants submit that the '808 patent fails the test of obviousness for the reason that it is an ineffective "combination" patent. A combination patent is one which draws together in a new format elements from separate, older inventions. In order for such a combination of prior art to be patentable, it must be synergistic, that is, "result[ing] in an effect greater than the

sum of the several effects taken separately." *Anderson's-Black Rock* v. *Pavement Co.*, 396 U.S. 57, 61, 90 S.Ct. 305, 308, 24 L.Ed.2d 258 (1969); *see also, Sakraida* v. *Ag Pro, Inc.*, 425 U.S. 273, 96 S.Ct. 1532, 47 L.Ed.2d 784 (1976); *Great A & P Tea Co.* v. *Supermarket Corp.*, 340 U.S. 147, 71 S.Ct. 127, 95 L.Ed. 162 (1950). The question of obviousness is to be determined by the application of a three-step analysis:

1. What is the scope and content of the prior art?
2. What differences exist between the prior art and the claims at issue?
3. What is the level of ordinary skill in the pertinent art?

See Graham v. *John Deere Co., supra, 383 U.S. at 17, 86 S.Ct. at 693.* Our previous discussion on the issue of anticipation should be helpful to our analysis of these points.

The prior art in this case is characterized by the Young and Getsinger patents, as well as the Lutz application. As we have seen, both the Young patent and the Lutz application depict a "pipe" or "jet" reactor, and although the Getsinger patent does not literally describe such a vessel, it is not therefore precluded from the adoption of such a device. *Arnold Pipe Rentals Co.* v. *Engineering Enterprises, Inc., supra.* There can be no reasonable dispute as to the fact that essentially the same chemical reaction takes place in all three of these processes, and that the same substance is produced. Although the range of temperatures at which the reaction occurs varies with the Young and Getsinger patents and the Lutz application, those temperatures overlap, not only as to each other, but as to the Kearns patent as well. Likewise, although the residence time attributable to each of these processes may vary, all of the residence times in question, measured by the standard of the '808 patent, fall within a one-second limit. Each of the es-

sential claims of the Kearns patent, then, are to be found in the prior art.

The answer to the first part of the *Graham* test helps to provide the solution to the second portion of that analysis. Any differences which may exist between the prior art and the '808 patent are trifling at best. Certain minor distinctions as to the equipment involved with the prior art, as compared to that used in the Kearns process, are present in this case, at least with regard to the Getsinger patent. But, as we have attempted to make clear, since the patent in suit is one for a chemical process, it is the method of that process which is crucial to the question of its patentability. And in this case, the methods by which all of the [1301] prior art processes, as well as the Kearns patent, arrive at the production of an ammonium polyphosphate fertilizer having self-sequestering properties are so similar as to make plaintiff's attempts to distinguish them little more than an overly technical exercise in nitpicking.

Finally, what was the level of ordinary skill in the art prior to or contemporaneous with the development of the Kearns process? Once again, the history of the prior art in this matter is suggestive of the answer to this question. The mere fact that Young Getsinger and Lutz were all, independently of each other, attempting to design a device for the production of an easily-appliable plant fertilizer is clearly indicative of the fact that those ordinarily skilled in the art were aware of a problem urgently in need of resolution. In addition, all three of these inventors arrived at the same solution to the problem, in that each of them sought to employ the same or a similar method in which streams of ammonia and phosphoric acid are contacted, under pressure, for similar time periods and at similar temperatures, to form the same product. We have in this case, then, three separate instances in which a prior art inventor developed a method which is conceptually identical to the one set forth in the patent in suit. All of this indicates to the

Court that the method or process claimed by Kearns was within the knowledge of the average artisan in the field, a conclusion which mandates a finding that the Kearns patent is invalid for obviousness. *See Concrete Appliances Co.* v. *Gomery*, 269 U.S. 177, 46 S.Ct. 42, 70 L.Ed. 222 (1925); *Novo Industrial Corp.* v. *Standard Screw Co.*, 374 F.2d 824 (7th Cir. 1967).

II. *INFRINGEMENT*

Assuming *arguendo* that the Kearns patent is valid, does the evidence in this case indicate that defendants infringed upon that patent? Plaintiff naturally contends that infringement is clearly made out here, arguing that defendants have encroached upon every material aspect of the Kearns claims. Defendants offer three major points in response to plaintiff's charge: first, that defendants' process is to be distinguished from that of plaintiff upon the ground that the former utilizes superphosphoric acid, while the latter restricts itself to the use of phosphoric acid; second, that the residence time of defendants' process is greatly in excess of that claimed by the '808 patent; and, third, that plaintiff is estopped to assert a claim of infringement in this action by operation of the legal doctrine of file wrapper estoppel.

A. *SUPERPHOSPHORIC ACID*

The record in this case is replete with seemingly endless discourses on the meaning of the terms "phosphoric" and "superphosphoric" acid, and on the question of whether or not the residence time of defendants' process exceeds one second. To the uninitiated, such discussions would appear to have as much relevance as a debate among medieval philosophers upon the question of how many angels can fit on the head of a pin. In a case such as this, however, such evidently trivial points take on far-reaching significance.

Since we have assumed, for this portion of our order, that the Kearns patent is valid, the issue of infringement will turn on whether there are significant differences between the '808 patent and the process used by defendants. In the context of this lawsuit, the word "significant" means any deviation from the patent as set forth by Kearns.

The Kearns patent contains the following language:

> "*Previous attempts to obtain non-gelatinous aqueous solutions of ammonium phosphate substantially free of insoluble solids have generally been directed to methods using superphosphoric acid.* Superphosphoric acid is made by further evaporation of 54% P_2O_5 phosphoric acid to about 70% P_2O_5. Superphosphoric acid, having a large percentage of its phosphate in the non-ortho form of which a large portion is in the pyro form, can be neutralized with ammonia in aqueous solutions without the metal ion impurities precipitating. However, superphosphoric acid is a premium chemical as [1302] large amounts of free and molecularly combined water must be evaporated from regular phosphoric acid. Furthermore, when superphosphoric acid is reacted with ammonia, the reaction is quite exothermic and heat must be subtracted from the system"[10] [Emphasis supplied.]

The patent goes on to declare that:

> "Still another object of this invention is the *elimination of the costly step of making superphosphoric acid in producing a non-precipitating liquid ammonium phosphate fertilizer.*"[11] [Emphasis supplied.]

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[10] Plaintiff's Exhibit 1, Col. 2, 11. 42-57 (emphasis supplied).

[11] *Id.*, Col. 3, 11, 13-16 (emphasis supplied).

Furthermore, throughout the patent, Kearns used the adjective "phosphoric" to describe the acid used in his process. Thus, the Abstract of the Disclosure states:

> "*Phosphoric* acid having P_2O_5 content of between about 55%-65% is reacted with ammonia . . ."[12] [Emphasis supplied.]

And when listing the objects of the patent, Kearns claims:

> "A further object of this invention is to provide a method whereby liquid ammonium polyphosphates of analysis higher than 10-34-0, and *derived from wet process phosphoric acid* . . ."[13] [Emphasis supplied.]

Finally, claim one of the patent declares:

> "A process for preparing ammonium polyphosphates having self-sequestering properties comprising: supplying a stream of ammonia to a jet reactor; supplying a stream of *phosphoric acid* . . ."[14] [Emphasis supplied.]

Apart from any considerations of estoppel, a matter which will be dealt with below, the most reasonable conclusion to be reached from all of this is that Kearns drew a definite distinction between "phosphoric" and "superphosphoric" acid, and that having made such a distinction, he wished to make it clear that his process was designed to utilize phosphoric acid. Since that is the case, defendants infringe the '808 patent only if they too use phosphoric acid.

How is "superphosphoric" acid to be defined? The evidence on the point is conflicting in this case. The

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[12] *Id.*, Col. 1, 11. 13-14 (emphasis supplied).

[13] *Id.*, Col. 3, 11. 9-12 (emphasis supplied).

[14] *Id.*, Col. 8, 11. 15-18 (emphasis supplied).

Court is not prepared to delve into all of the technical aspects of the question. It does appear, however, that those knowledgeable in the art, including the inventor, are in general agreement that superphosphoric acid is distinguished by the fact that it has "substantial" amounts of polyphosphate. The evidence is that Kearns regarded an ammonium polyphosphate level of 20% and above to be required in order for an acid to fit into the superphosphoric category.[15] Testimony at trial, presented by both sides, emphasized that the presence of polyphosphates is necessary in order for an acid to qualify as superphosphoric.[16] Evidence adduced by plaintiff indicates that the acid used by defendants had a polyphosphate content of above 20%,[17] and plaintiff refers to the polyphosphate level of defendants' acid as being in the area of 15%-20%.[18]

The starting acid used by defendants therefore appears to fit the "superphosphoric" definition, at least as to polyphosphate content. What of the P_2O_5 level of the acid? Looking to the Kearns patent, once again, we find that superphosphoric acid is defined as having a P_2O_5 content of "about 70%."[19] The evidence as to the meaning of the term "about 70%" is naturally conflicting, and the parties argued endlessly about the precise definition of the phrase. We prefer to take a common sense approach. [1303] Plaintiff has cited defendants' acid as having a P_2O_5 content of 68%.[20] This is documented by defendants' company records, introduced in

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[15] Defendants' Exhibit F; Plaintiff's Exhibit 1, Col. 3, 11. 25-27.

[16] Testimony of Raymond Waters, Tr. p. 77, 11. 17-18; Testimony of W. E. Rushton, Tr. p. 382, 11. 19-24.

[17] Plaintiff's Exhibit 25.

[18] Plaintiff's Post-Trial Reply Brief, p. 9.

[19] Plaintiff's Exhibit 1, Col. 2, 11. 46-48.

[20] Plaintiff's Post-Trial Reply Brief, p. 9.

evidence by plaintiff."[11] We conclude that an acid having a P_2O_5 content in the area of 68% would be generally recognized in the community as having a P_2O_5 content of "about 70%." Defendants' acid thus falls within the definition of "superphosphoric" acid, both as to its phosphate level and as to its P_2O_5 content. As defendants' acid is therefore superphosphoric, it may not infringe the '808 patent, which calls for the use of phosphoric acid.

B. *RESIDENCE TIME*

The question of "residence time"—how that time is to be determined, and whether the residence time of defendants' process is the same as or greater than that found in the Kearns patent—is the most hotly contested issue in this case. We have already discussed the matter at some length in finding the '808 patent invalid. Plaintiff contends that its definition of residence time measures the time required to adequately mix the reactants, and says that such time is best measured by examining the residence time of the steam produced by the reaction, assuming that the melt of ammonium phosphate is entrained in and traveling at the same speed as the steam. Defendants stand on the proposition that residence time is in fact the residence time of the melt alone. Plaintiff violently opposes defendants' position, and has spent an inordinate amount of time attempting to refute it. Several important points, however, stand out on the question of residence time, apart from arguments advanced by the parties. Plaintiff contends, for example, that there is nothing in the Kearns patent which teaches that residence time is to be measured in terms of the melt. As we have pointed out, however, there is also nothing in the Kearns patent, or in any of the other patents before the Court, which "teaches" that residence time is to be measured by the residence time of the

[11] Plaintiff's Exhibit 26.

steam involved. One looks in vain for such a formula. Secondly, although plaintiff now maintains that its definition of residence time has always been based on the time required for adequate mixing of the reactants, and that the residence period of the steam is simply the best measure of that time, such a distinction, if there be any, has not been made apparent to the Court. Indeed, when the question of residence time was the subject of inquiry, plaintiff's counsel persistently developed the theme that its method of measurement was correct, since according to its theory the melt was entrained with the steam and traveled at the same speed. Such an argument is only directed at refuting a contrary position set forth by defendants; it does nothing to establish that residence time is actually to be measured in terms of the time necessary to adequately mix the reactants. Finally, plaintiff has been sharply critical of certain tests made by defendants' expert witness, Dr. Busot. Plaintiff has declared the tests to be inaccurate and unscientific. The tests, conducted by Dr. Busot in order to determine the residence time of the melt in defendants' apparatus, showed generally that the residence time of defendants' process is longer than one second. But, although plaintiff has criticized the method, assumptions and conclusions of Dr. Busot, the fact remains that defendants are the only parties in this suit to have conducted any tests relevant to the issues in the case. To the knowledge of the Court, plaintiff conducted no such tests of either defendants' or its own equipment. Plaintiff's only evidence on the question of residence time consisted of calculations made by one of its experts, without the benefit of any actual experimentation.

The Court has previously concluded, on the issue of the validity of the Kearns patent, that more than one viable method of measuring residence time is available here. We believe that the same conclusion is applicable to the question of infringement as well. Defendants' process does not infringe the '808 patent, because the resi-

dence time of the ammonium phosphate melt is more than one second. Defendants' experimental evidence as to residence time indeed may [1304] have been scientifically weak; plaintiff, however, offered no experimental evidence to refute that of defendants, and the Court will not discount that evidence solely on the basis of the arguments of plaintiff's counsel or the testimony of plaintiff's expert witness, grounded as that testimony was upon abstract calculation and theory.

C. *FILE WRAPPER ESTOPPEL*

The doctrine of file wrapper estoppel may be stated in the following manner:

> ". . . the essence of the doctrine is that a patentee may not expand his allowed claims by interpretation to embrace features which he disclaimed in order to overcome objections by the Patent Office on the basis of prior art disclosures. . . . " *McCullough Tool Co.* v. *Well Surveys, Inc.*, 343 F.2d 381, 403 (10th Cir. 1965).

File wrapper estoppel may arise from an applicant's conduct, including arguments made to the Patent Office, during the prosecution of his patent application. *CMI Corp.* v. *Metropolitan Enterprises, Inc.*, 534 F.2d 874 (10th Cir. 1976). The doctrine comes into play in any situation in which the patentee, as a consequence of the fact that the accused process does not read directly upon the claims of the patent in suit, is forced to rely on the doctrine of equivalents, an accused process may infringe in spite of the fact that it does not read literally upon the patent in suit, if it can be shown that it does the same work as the patented invention in substantially the same way and accomplishes the same result.

Plaintiff's position on the question of file wrapper estoppel is that the doctrine has no application in this case. Plaintiff holds firmly to the argument that:

"... If accused matter falls clearly within the claim, infringement is made out and that is the end of it." *Graver Mfg. Co.* v. *Linde Co.*, 339 U.S. 605, 607, 70 S.Ct. 854, 855, 94 L.Ed. 1097 (1950).

According to plaintiff, if infringement is clearly made out, there can be no file wrapper estoppel. *King-Seeley Thermos Co.* v. *Refrigerated Dispensers, Inc.*, 354 F.2d 533, 541 (10th Cir. 1965). The problem with this line of argument, of course, is that the Courthas determined that in this case infringement is not clearly made out. The doctrine of file wrapper estoppel therefore does apply here.

Defendants raised the issue of file wrapper estoppel in connection with the argument that their process does not infringe the '808 patent, in view of the fact that the Kearns patent uses phosphoric acid, while defendants' process utilizes superphosphoric acid. Defendants point out that Kearns' original claims were rejected as "unpatentable" over the Hignett Patent, No. 3,171,733.[23] Kearns' original claims called for the use of phospohric acid.[24] In response to the rejection of his claims, Kearns argued to the Patent Office that:

> ". . . It is respectfully pointed out that the Hignett process calls for superphosphoric acid, I.E., a P_2O_5 content of 74-85% as the phosphate source. On the other hand, applicant's starting reactant is wet process phosphoric acid having a P_2O_5 content of between about 55-65% . . . However, the process now under consideration calls for an acid having essentially no polyphosphates . . ."[25]

The reaction of the patent examiner to this argument was to begin to compare the claims of Kearns to those

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[23] Defendants' Exhibit R-21A, Cols. 3 and 6.

[24] *Id.*, Col. 1.

[25] *Id.*, Col. 3.

found in the Getsinger patent, a patent calling only for the use of simple phosphoric acid."[22] The point of defendants' argument is that, in view of Kearns' representations to the Patent Office regarding the use of phosphoric acid in his patent, plaintiff is estopped to contend that defendants' process infringes the Kearns patent, since to do so would necessarily mean that the claims of the patent would be expanded to include the use of superphosphoric acid. The rule of law supports defendants' position:

> "A patentee having *argued* a narrow construction for his claims before the United States Patent and Trademark Office [1305] should be precluded from arguing a broader construction for the purposes of infringement." *Coleco Industries* v. *United States International Trade Commission*, 573 F.2d 1247, 1248 (C.C.P.A. 1978). [Emphasis supplied.]

See also, CMI Corp. v. *Metropolitan Enterprises, Inc., supra.*

The effect of the doctrine of file wrapper estoppel in this case, then is to provide an independent ground for a finding of no infringement by defendants' process, in view of our previous determination that defendants' process utilizes superphosphoric acid.

III. *CONCLUSIONS*

The testimony and evidence adduced in this case have convinced this Court not only that the Kearns patent is invalid, but also that even if it were valid there would be no infringement of it by defendants' process. The Court is aware of the fact that in rendering this opinion, it places itself in conflict, in some respects, with the decision of the Honorable Judge Morey L. Sear in *Swift Chemical Co.* v. *Usamex Fertilizers, Inc., 197 U.S.P.Q. 10 (E.D.La.1977)*. The principle area of distinction be-

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[22] Defendants' Exhibit R-21B, Cols. 1 and 4.

tween the two cases is that in *Usamex* Judge Sear found the '808 patent to be valid and enforceable. The Court wishes to make clear that it has the utmost respect for Judge Sear and his opinion in the *Usamex* case. At the same time, however, it is readily apparent that there are fundamental differences between this and the *Usamex* case. The existence of these basic differences, coupled with the fact that under the circumstances we are not bound to the *Usamex* decision by the principles of *res judicata* or *stare decisis*, necessarily lead the Court to a decision which apparently contradicts *Usamex*.

In *Usamex*, apart from questions relating to the validity of the Kearns patent, the only pertinent issues before the Court were the issue of infringement and the question of whether the parent corporation, Fertilizantes Fosfatados Mexicanos, S.A., could be held directly liable to Swift as an infringer. In this action, no question has been raised with respect to parent corporation liability. On the subject of infringement, the Court in *Usamex* was concerned solely with deciding whether the "tee reactor" used by the defendants constituted a "jet reactor," thereby infringing upon the claims of the Kearns patent. In this action, as we have seen, the main areas of contention with regard to the matter of infringement are the definition of superphosphoric acid and the determination of residence time. The important superphosphoric acid issue was not before Judge Sear in any fashion. And while Judge Sear did consider the problem of residence time, the circumstances in which he did so were much different than those present in this case.

Turning to the subject of the validity of the Kearns patent, it appears that in *Usamex* the defendants pursued two lines of attack. The first involved a charge that the patent in suit was invalid due to the fact that the claims contained therein were not stated with sufficient particularity. Such an issue did not arise in this action. The defendants in *Usamex* also attacked the validity of the '808 patent on the ground that the invention

would have been obvious to anyone skilled in the art. Addressing this problem, Judge Sear pointed out that Swift made claims of non-obviousness in only two areas—the prescribed temperature range and residence time. In the present action, there is no issue regarding the temperature range of the reaction, because it is clear that defendants' process does operate at the same general temperatures as those set forth in the '808 patent. With regard to residence time, the gist of Judge Sear's opinion was that the Kearns patent could not have been obvious on that ground, since it was the first patent in the area to emphasize the importance of a short residence time to the success of the process. Since this was the thrust of the *Usamex* opinion on this point, there was evidently no evidence introduced on the question of whether representatives of the prior art might have been characterized by a residence time equal to or shorter than that prescribed by the Kearns patent. There was also no discussion in *Usamex* of the fact that more than one method for determining residence time does exist.

[1306] In short, as between the Court's opinion in this action and that of Judge Sear in *Usamex*, there are really only two points of comparison. In both cases, the relative shapes of the reactors were considered. In that respect, Judge Sear's opinion is supportive of the Court's decision here, since Judge Sear held that the type of reactor applicable to the Kearns process could not be strictly limited by the description found in the patent. *Usamex, supra, 197 U.S.P.Q. at p. 18.* This Court made the same point in demonstrating that the prior art might not be distinguished from the Kearns patent simply on the basis of the types of reactors described in the prior art. The only other issue addressed in both cases was that of residence time. The Court believes that a different result on this point was reached here simply because the question was fully broached before this Court, as it was not in *Usamex.*

IV. *FINDINGS OF FACT* and *CONCLUSIONS OF LAW*

A. *FINDINGS OF FACT*

1. This Court has jurisdiction over this action for infringement of a United States Patent, under 28 U.S.C. § 1338(a), and venue is proper under 28 U.S.C. § 1400(a).

2. Plaintiff Swift Agricultural Chemicals Corporation (now known as Estech General Chemicals Corporation) is a Delaware corporation having its principal place of business in Chicago, Illinois.

3. Defendant Farmland Industries, Inc. is a Kansas corporation having its principal place of business in Kansas City, Missouri.

4. Defendant Farmers Chemical Company, a wholly owned subsidiary of Farmland, is a Kansas corporation having its principal place of business in Joplin, Missouri.

5. The Young patent, No. 3,044,851, discloses a process that is materially identical to that described in the Kearns patent in suit, No. 3,464,808, in that it discloses a continuous reaction between phosphoric acid and ammonia, in a tubular reactor, at a temperature of between 450° F and 650° F, with a residence time of less than one second, involving simultaneous neutralization and molecular dehydration, and producing an ammonium polyphosphate fertilizer bearing self-sequestering properties.

6. The Getsinger patent, No. 3,382,059, discloses a process that is materially identical to that described in the Kearns patent in suit, No. 3,464,808, in that it discloses a continuous reaction between phosphoric acid and ammonia, in a tubular reactor, at a temperature of between 450° F and 650° F, with a residence time of less than one second, involving simultaneous neutralization and molecular dehydration, and producing an ammonium polyphosphate fertilizer bearing self-sequestering properties.

7. The application of Lutz and Rubio, Serial No. 352,764, discloses a process that is materially identical to that described in the Kearns patent in suit, No. 3,464,808, in that it discloses a continuous reaction between phosphoric acid and ammonia, in a tubular reactor, at a temperature of between 450° F and 650° F, with a residence time of less than one second, involving simultaneous neutralization and molecular dehydration, and producing an ammonium polyphosphate fertilizer bearing self-sequestering properties.

8. The prior art in this case consists of patents, applications and other work. These matters demonstrate the level of ordinary skill in the art at all times relevant to the development and filing of the Kearns application. They indicate that the skilled artisan in the field, prior to the filing of the Kearns application, had sufficient knowledge of his art to enable him to combine all of the limitations claimed in the '808 patent.

9. The Kearns patent in suit disclaims the use of superphosphoric acid as a starting acid, and makes clear that said starting acid is composed of phosphoric acid. One of the advantages claimed for the '808 patent is stated to be the elimination of the expensive step of making superphosphoric acid in the production of liquid fertilizer.

10. The Kearns patent in suit claims a residence time for the reactants in the reactor of less than one second. The patent does not disclose how its contact period or residence time of less than one second is to be measured. [1307] 11. As a result of statements in the patent specification and representations made to the Patent Office during the prosecution of the application, as reflected in the file history, plaintiff is estopped to assert that the claims of the Kearns patent are broad enough to include the use of superphosphoric acid.

12. The method by which plaintiff measures the residence time of its process is based on the assumption

that the ammonium phosphate melt is entrained in and moving at the same speed as the steam generated by the chemical reaction inside the reactor. That method was derived solely from mathematical calculations, and is grounded in abstract scientific theory. Plaintiff conducted no physical tests to demonstrate the veracity of its method for calculating residence time.

13. The method by which defendants measure the residence time of the reactants in their process is based on the notion that the products of the reaction move at different speeds relative to each other. Defendants have conducted actual physical tests concerning the residence time of their reactor. Those tests indicate that the residence time of defendants' process is more than one second.

14. No evidence was introduced in this case which would show that the method of measuring residence time used by defendants in connection with their own reactor was inappropriate to the reaction in question, or that such method was unavailable to engineers, chemists, physicists, patent attorneys and others skilled in the art at the time of or prior to the filing of the Kearns application.

15. Defendants utilized a definition of residence time developed by plaintiff to measure the residence time of certain other analogous processes for the manufacture of ammonium phosphate fertilizer. There was no showing that plaintiff's method for measuring residence time was inappropriate for such a purpose, or that such method was unavailable to engineers, chemists, physicists, patent attorneys and others skilled in the art at the time of the development of the analogous prior art processes.

16. Defendants' use of superphosphoric acid is outside the scope of the claims found in the Kearns patent.

17. The residence time of the defendants' process, since it exceeds one second in duration, is beyond the scope of the claims of the Kearns patent.

B. *CONCLUSIONS OF LAW*

1. Plaintiff is estopped to assert that the claims of U.S. Patent No. 3,464,808 are broad enough to encompass the use of superphosphoric acid, owing to representations made to the Patent Office during the prosecution of the application.

2. By reason of anticipation by the prior art, pursuant to 35 U.S.C. § 102, all of the claims of U.S. Patent No. 3,464,808 are invalid.

3. By reason of obviousness, pursuant to 35 U.S.C. § 103, all of the claims of U.S. Patent No. 3,464,808 are invalid.

4. If U.S. Patent No. 3,464,808 was a valid patent, it is not infringed by defendants' commercial processes, in view of the fact that the residence time of the chemical reaction in defendants' commercial processes is more than one second in duration, and therefore exceeds the residence time claimed for U.S. Patent No. 3,464,808.

5. If U.S. Patent No. 3,464,808 was a valid patent, it is not infringed by defendants' commercial processes, in view of the fact that defendants' commercial processes use superphosphoric acid, whereas U.S. Patent No. 3,464,-808 is limited to the use of phosphoric acid.

Counsel for defendants are directed to prepare, circulate and submit to the Court a Journal Entry to reflect this Order.

IT IS SO ORDERED.

APPENDIX C

[10] 197 USPQ 10

District Court, E. D. Louisiana

Swift Chemical Company

v.

Usamex Fertilizers, Inc., et al.

No. 74-46 Decided Oct. 7, 1977

[12] Sear, District Judge.

This is an action for infringement of U.S. Patent 3,464,808 (hereinafter referred to as the '808 patent), entitled "Manufacture of Ammonium Polyphosphate from Wet Process Phosphoric Acid" owned by plaintiff Swift Agricultural Chemical Company (Swift). Defendants Usamex Fertilizers, Inc. (Usamex) and Fertilizantes Fosfatados Mexicanos, S.A. (FFM) have denied infringement and have asserted as affirmative defenses, that the patent is invalid on various grounds, and is unenforceable by reason of alleged fraud on the part of plaintiff during prosecution of the application which resulted in the patent.

By counterclaim, and as affirmative defenses, defendants further assert that the 808 patent is unenforceable because plaintiff has misused it as part of a plan to illegally restrain trade in interstate commerce, and has thereby or otherwise violated the antitrust laws of the United States. Trial of these issues has been severed and stayed pending determination of the infringement, validity and fraud issues.

I. Jurisdiction

The suit arises under the patent laws of the United States, 28 U.S.C 1338, and venue is proper in the Eastern District of Louisiana.

II. The Parties

Swift is engaged in the business of making, using and selling various fertilizer products including liquid ammonium polyphosphate ("APP") made by the process described and claimed in the 808 patent.

Usamex engages in the manufacture of liquid ammonium polyphosphate fretilizer (APP) for sale in the United States. Since its incorporation in 1976 all of the outstanding stock in Usamex has been owned by FFM. [13] FFM is engaged in Mexico in the manufacture of wet process phosphoric acid, including liquid fertilizer grade acid which it supplies to Usamex for use in the manufacture of liquid APP.

III. The Patent

The invention of the '808 patent was made by Tommy Carter Kearns who was employed in fertilizer research and development by Swift. The patent discloses a method of producing a liquid ammonium polyphosphate fertilizer product by reacting ammonia and wet phosphoric acid under conditions which simultaneously neutralize and molecularly dehydrate the acid.[1] Because of its relatively high polyphosphate content, the resulting reaction product, when dissolved in water, has self-sequestering properties, i.e., forms a solution wherein impurities such as iron and aluminum salts, present in the wet process phosphoric acid, are sequestered or held in solution, instead of precipitating out in the form of a gelatinous sludge which would hinder subsequent storage and handling of the liquid fertilizer product. More particularly,

[1] Plaintiff's Exhibit 1.

the method involves a direct ammoniation of orthophosphoric acid in such a manner that the exothermic heat of the reaction supplies the energy requirements to molecularly dehydrate the acid, i.e., convert a substantial portion of the orthophosphates to polyphosphates without formation of appreciable quantities of highly insoluble iron tripolyphosphates and metaphosphates.

IV. The Basic Technology Involved

Fertilizer is normally characterized by an N-P-K analysis, i.e., the percentages of nitrogen, phosphorous (expressed as P_2O_5) and potassium (expressed as K_2O) contained in it. The '808 patent concerns the combining of the first two of these plant nutrients. For example, the nominal 10-34-0 product referred to in the patent would contain about 10% nitrogen and about 34% phosphate. The source of the nitrogen is ammonia (NH_3). The source of the phosphate is phosphoric acid (H_3PO_4).

Phosphoric acid is commercially available in three forms. Each is derived from phosphate rock mined in various locations throughout the world. The degree of concentration of acid solution in each is normally expressed in terms of its phosphorous pentoxide (P_2O_5) content.

The phosphate rock from which phosphoric acid is derived contains impurities. These impurities include relatively large amounts of iron oxide or its hydrates, as well as aluminum and other metal salts and oxides. Total impurities may comprise 15-25% by weight, of the rock. Depending upon the process by which the rock is converted into phosphoric acid, some or all of these impurities may be eliminated.

The first of three forms of industrial phosphoric acid is acid made by the "electric furnace" method. "Furnace acid" is a premium chemical which, because of the nature of the process by which it is produced, contains virtually no metal impurities. It is very expensive and

this fact has deterred its use in the manufacture of fertilizers.[2]

The second and third forms of industrial phosphoric acid are produced by the so-called "wet process" method. Ordinary or merchant grade "wet process acid" is usually concentrated to a P_2O_5 content of about 54% of the solution. By further concentration, through evaporation of free water from the solution, the P_2O_5 content may be raised up to about 68%.

In the second form of industrial phosphoric acid, wherein the wet process acid is concentrated to a P_2O_5 content of about 54% to about 58%, the phosphates are substantially in the non-polymerized or ortho form, and there is little if any non-ortho or polyphosphate formation. Such acid is sometimes referred to as "orthophosphoric acid" and, because it is the least expensive of the three forms, it is a desirable source of phosphorous for the fertilizer industry.[3]

In the third form of industrial phosphoric acid, wet process acid is subjected to high heat sufficient to evaporate water which is molecularly combined with the acid. After such molecular dehydration, the P_2O_5 content will be about 70% higher. And as a result of the molecular dehydration, a substantial proportion of the orthophosphates will polymerize or be converted into the non-ortho or polyphosphate form. This acid is referred to as "superphosphoric acid". It is expensive.[4]

In wet process acid, whether orthophosphoric or superphosphoric acid, some of the metal impurities which originated in the phosphate rock remain dissolved in the strongly acidic solution. So long as the acidity is maintained and the impurities remain in solution, they present no significant problem. When wet process acid

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[2] Uncontested fact 18.

[3] Uncontested facts 14-17.

[4] Id.

[14] is neutralized with ammonia in the preparation of a liquid plant food, however, the solubility of impurities such as iron and aluminum compounds is affected and potential problems are presented. In neutral or near neutral solution, the iron and aluminum impurities tend to come out of solution and form a gelatinous, sludge-like precipitate. This precipitate will settle and clog the equipment used to transfer, store further process and apply the fertilizer solution.[8]

The desirability of liquid fertilizers, as opposed to dry granulated products, has long been recognized. The advantages of liquid fertilizers include (a) ease of distribution and application to crop lands through conventional pumping and spraying methods, (b) better homogeneity of plant nutrients within the fertilizer product, (c) elimination of difficulties due to dust and caking which are characteristic of dry products, (d) more efficient application to roots and foliage of the crop, (e) improved solubility and availability to the plant, (f) improved capability for blending with other fertilizer and agricultural chemicals such as micronutrients, pesticides and herbicides, and (g) higher crop yields.[9]

The advantages of liquid over dry fertilizers could not be fully realized unless the fertilizer solutions were substantially free of gelatinous sludge-like precipitates such as are formed by iron and aluminum impurities. Moreover, the analysis of the fertilizer solutions should be high, i.e., at least 10% nitrogen and 34% phosphorus, and the cost of the liquid mixtures should be competi-

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[8] Plaintiff's Exhibits 3, 8, 22, 23, 27, 76; Testimony of Raymond L. Waters.

[9] Plaintiff's Exhibits 8, (3-4), 124 (627-628), 215 (19-20); Testimony of Raymond L. Waters and Everett N. Mortenson.

tive with comparable high analysis dry fertilizer mixtures. Various attempts were made over the years to achieve this goal.[7]

The search for a process of preparing liquid ammonium phosphate fertilizer products which were substantially free from precipitates was spearheaded by the Tennessee Valley Authority (TVA), which instituted a National Fertilizer Development Center at Muscle Shoals, Alabama in 1964. Between 1964 and 1968, TVA's efforts were confined to developing a two stage process first described in U.S. Patent No. 3,382,059 issued to J. G. Getsinger[8] (hereinafter referred to as the Getsinger patent). The Getsinger patent describes a process by which wet process phosphoric acid is concentrated through evaporation in a first stage tank before being reacted with ammonia in a second stage tank. The commercial development of the Getsinger process was hampered by the failure to effectively eliminate from the process the formation of undesirable insoluble iron and aluminum polyphosphate compounds.[9]

The '808 patent in suit developed by Kearns purports to solve the problems of the TVA process. Its objectives are:

> ". . . to produce an ammonium polyphosphate which possesses metal iron sequestering ability when dissolved in an aqueous system."
>
> ". . . the production of ammonium polyphosphate without the formation of appreciable quantities of highly insoluble iron tripolyphosphate and metaphosphate."
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> ". . . to provide a method whereby liquid ammonium polyphosphates of analysis higher than 10-34-0, and derived from wet process phosphoric acid, can be obtained." and

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[7] Plaintiff's Exhibits 3, 8, 22, 23, 24, 80, 126, 127, 128A.

[8] Defendants' exhibit 34.

[9] Plaintiff's exhibits 126-128.

". . . the elimination of the costly step of making superphosphoric acid in producing a non-precipitating liquid ammonium phosphate fertilizer."[10]

The process is defined in the patent claims:

"1. A process for preparing ammonium polyphosphates having self-sequestering properties comprising: supplying a stream of ammonia to a jet reactor; supplying a stream of phosphoric acid having a P_2O_5 content of between about 50% and about 69% to said jet reactor and contracting said stream of ammonia with said stream of phosphoric acid in said reactor at temperatures of between about 450°F. and about 650°F. for a period of less than one second to form molten droplets of ammonium polyphosphate."

"2. The method of claim 1 wherein the droplets of molten ammonium polyphosphate are subsequently quenched."

"3. The process of claim 1 wherein the P_2O_5 content of the acid is between about 60% and about 62%."

"4. The process of claim 1 wherein at least 50% of the orthophosphate in the acid is converted to nonorthophosphate."[11]

[15] The process of the patent in suit enables the direct ammoniation of wet process, orthophosphoric acid to produce, in a single and virtually instantaneous reaction, molten ammonium polyphosphate which when quenched in water forms a stable high analysis fertilizer solution having self-sequestering properties and which is free from insoluble polyphosphate compounds such as iron tripolyphosphate and metaphosphate. The apparatus required to carry out the patented process is relatively simple and inexpensive, and has long been known and readily available to those working in the field.

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[10] Plaintiff's exhibit 2, col. 3, lines 1-16.

[11] Id. (Col. 8, lines 14-41).

A significant feature of the process is that the ammonia and phosphoric acid are contacted in a reactor at a temperature of from about 450°F. to 650°F. for a duration of less than one second, after which the reaction product is quenched or cooled. Such rapid reaction at a high temperature referred to as "residence time" was found by Kearns to produce an ammonium polyphosphate melt in which a high percentage of the phosphate was in the non-ortho form, yet with little or no formation of undesirable insoluble iron and alumninum polyphosphate compounds.

In order to provide for such extremely brief residence time at high temperature, the patent requires the use of an elongated, open-ended pipe in which to contact the ammonia and phosphoric acid as opposed, for example, to a tank or other such reaction vessel. The patent describes the reaction pipe as a "jet" or "jet reactor", and the process is sometimes referred to as a "jet process".

Kearns filed his application for the patent in suit on August 18, 1965, and it was issued on September 2, 1969.

In 1967-68, Swift introduced on the market its high analysis liquid ammonium polyphosphate fertilizer products and since that time, has successfully operated the process at plants in Memphis, Tennessee, Mt. Pulaski, Illinois, Uncle Sam, Louisiana and, currently, at Bartow, Florida.[12]

The first description of the Kearns-Swift process of the '808 patent available to the public appeared in September, 1967, when a Swift patent corresponding to the Kearns U.S. application was published in France.[13] Descriptions of the process were first published in the United States in the July, 1968 issue of Chemical Abstracts and in September, 1968, in a TVA publication entitled Fer-

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[12] Plaintiff's exhibits 9, 11; testimony of Raymond L. Waters.

[13] Plaintiff's exhibit 12.

tilizer Abstracts.[14] Shortly after the article in Fertilizer Abstracts appeared, TVA incorporated aspects of the '808 process into its research efforts on the Getsinger process. The tank used as a reactor in the second stage of the Getsinger process was replaced with an elongated pipe or "tee" reactor and the residence time of the reactants in the reactor was reduced from minutes to seconds. By October, 1968, TVA reported that the use of the "tee" reactor and shorter retention times had eliminated the previously existing problem in the Getsinger process of the presence of insoluble impurities in the final fertilizer product.[15]

The process used by defendant Usamex at its St. Rose plant originated at Ferguson Industries (Ferguson), a fertilizer processing equipment manufacturer based in Dallas, Texas. Prior to 1968, Ferguson's efforts were directed at manufacturing liquid fertilizer from superphosphoric acid.[16] By 1968, however, Ferguson had joined in the search for a direct process which would eliminate the intermediate step of producing superphosphoric acid and was monitoring the search efforts at TVA.[17]

In October, 1968, representatives of Ferguson attended a public demonstration of the new TVA process using the tee reactor and the the lower residence time[18] and on October 31, 1968, William Schenewerk, a Ferguson employee, filed a patent application for a process for producing liquid fertilizer directly from wet process phosphate acid similar to that described in the '808 patent.[19] The process described in Schenewerk's application became the basis of what Ferguson came to call its "Poly-

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[14] Uncontested fact 41; plaintiff's exhibits 12, 15, 16.

[15] Plaintiff's exhibits 127, 128.

[16] Plaintiff's exhibits 17, 18.

[17] Plaintiff's exhibits 205, 211.

[18] Plaintiff's exhibit 128.

[19] Plaintiff's exhibit 20.

Actor Phase IV" process for producing liquid fertilizer. By January, 1969, Ferguson proclaimed to the industry that it had developed the first successful process for manufacturing liquid fertilizer directly from wet process phosphoric acid.[20] Shortly thereafter Ferguson built a pilot plant to demonstrate the PolyActor Phase IV process to potential customers and licensees, one of whom was defendant FFM[21] a Mexican producer of wet process phosphoric acid.

In 1969, FFM became interested in locating a market for its wet process [16] phosphoric acid in the United States. Recognizing that the liquid fertilizer industry in the United States might provide such a market, FFM began to investigate and evaluate processes for manufacturing liquid fertilizer directly from wet process acid. One of the processes investigated was the PolyActor Phase IV.[22] FFM hired a former employee, Tom V. Burns, to evaluate Ferguson's PolyActor Phase IV pilot plant in the summer of 1969.[23] Burns inspected the process and reported to FFM.[24]

In the initial stages of its production of the PolyActor Phase IV process, it was Ferguson's intention to grant licenses for use of the process to customers who purchased Ferguson equipment. During the summer of 1969, however, these plans were abandoned. Ferguson became aware of Swift's French patent and, upon inquiry, learned that the 808 patent was about to issue. Rather than compete with Swift, Ferguson decided to sell outright whatever rights it had to the process and the pending Schenewerk patent.[25] By November, 1969, Ferguson and

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[20] Plaintiff's exhibits 22, 23, 26, 27, 206, 210.

[21] Plaintiff's exhibits 25, 28, 210, 221.

[22] Plaintiff's exhibits 31, 93, 205, 208.

[23] Plaintiff's exhibit 203.

[24] Plaintiff's exhibits 34, 35.

[25] Plaintiff's exhibits 32, 36, 206.

FFM were actively negotiating the sale of the process and the pending patent application.[26] Having been advised by Ferguson of the existence of the '808 patent, FFM attempted through the employment of patent counsel to determine whether the Ferguson process would infringe it.[27]

While potential infringement was being investigated, FFM proceeded with its plans to buy the process and Ferguson began building the first plant scale unit. A joint venture corporation, AMEX Fertilizers, Inc. (AMEX), was formed by FFM and APCI Farm Chemicals, Inc., a subsidiary of APCO Oil Company, to purchase the process from Ferguson. In June, 1970, however, FFM learned that APCO Oil Company had sold its farm chemical subsidiary and that the subsidiary had become the Jon-T Chemical Company. Shortly thereafter, the joint venture was dissolved and AMEX became a wholly owned subsidiary of FFM, which assumed the contract to purchase the Ferguson plant scale equipment and the Schenewerk patent application.[28]

Having obtained a legal opinion that the PolyActor Phase IV process would not infringe the Swift patent, FFM proceeded with the purchase of the plant scale equipment that Ferguson was erecting at Atchison, Kansas and the Schenewerk patent application for $85,500.00 conditioned only on the success of the performance tests at the Atchison plant.[29] To manufacture and market the liquid fertilizer product, FFM formed Usamex as a wholly owned United States subsidiary.[30] A site for the new plant at St. Rose, Louisiana was chosen and Burns was

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[26] Uncontested fact 47.

[27] Plaintiff's exhibits 40-44, 46-49; defendants' exhibit 1.

[28] Plaintiff's exhibits 53-56, 61-63, 66.

[29] Plaintiff's exhibits 53, 61.

[30] Plaintiff's exhibits 57-60.

hired to supervise the plant operations.[31] When the process had been developed to FFM's satisfaction, FFM purchased the equipment and patent application, and sold them in turn to Usamex in exchange for Usamex's common stock. By January, 1971, the equiment was installed at the plant at St. Rose.[32]

Meanwhile, Usamex abandoned the prosecution of the Schenewerk patent[33] and a second application, similar to the Schenewerk application, was filed in the name of Tom V. Burns.[34] The Burns' application was permitted and issued as U.S. Patent No. 3,734,708 on May 22, 1973.[35] By March, 1971, the Burns process was in operation at the St. Rose plant and has been used to manufacture liquid fertilizer at the plant up to the present time.[36]

V. Plaintiff's Contentions

Swift contends that defendants use the steps of its patented process in the production of a high analysis, self-sequestering, liquid APP product, and thus operate in substantially the same manner to obtain the same result as that disclosed and claimed by the '808 patent in suit.

Swift further contends that defendants' infringement is willful, that defendants were aware of the patent at the inception of infringement, and that defendants' modification of its original jet reactor, by changing the positioning of the inlet tubes, was subterfuge.

Finally, Swift contends that Usamex and FFM are joint tort feasors in the infringement, and jointly liable.

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[31] Plaintiff's exhibit 66.

[32] Plaintiff's exhibits 58, 64, 65, 78, 81, 82.

[33] Plaintiff's exhibit 89.

[34] Plaintiff's exhibits 3, 4.

[35] Plaintiff's exhibit 3.

[36] Plaintiff's exhibits 82, 87, 90, 203.

VI. Infringement

A. Literal Infringement and the Doctrine of Equivalents

[17] Defendants do not contest the fact that the process used at St. Rose is the same as that described in the '808 patent.[37] In the process at St. Rose, wet process phosphoric acid having a P_2O_5 content of about 60% is reacted with ammonia under conditions that simultaneously neutralize and molecularly dehydrate the acid so that about 55% of the orthophosphate is converted to polyphosphate resulting in a self-sequestering, high analysis fertilizer.[38] Moreover, defendants admit that the St. Rose process employs the process steps recited in claims 1-4 of the '808 patent in suit. The ammonia is supplied to the closed end of the reactor pipe, the 60% P_2O_5 phosphoric acid is supplied to the same end, acid and ammonia are contacted at a temperature of between 450°F. and 650°F. in the reactor for less than one second[39] to form a molten fertilizer product and steam, the molten material is quenched and dissolved in water, and the solution is neutralized to a pH of about 6.[40]

The basis of the defense to infringement and the ground upon which defendants distinguish the St. Rose process from the Swift process is their contention that

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[37] During the trial, defendants did assert at one time that the operation carried out at St. Rose does not infringe the '808 patent because the reactor residence time at St. Rose was greater than one second. Defendants' witness, William M. Mustian, Jr., stated that he observed an ex parte test run of the St. Rose equipment and calculated that the residence time of the ammonium polyphosphate melt in the reactor was longer than one second. Following Mustian's testimony, however, defendants withdrew this defense and did not call a second witness who also observed the ex parte test run.

[38] Uncontested facts 19, 31.

[39] See note 40 supra.

[40] Uncontested facts 21-29.

the scope of the '808 patent is not sufficiently broad to encompass the use of the process with a conventional tee reactor, rather than the "jet reactor" described in the '808 patent. Essentially, defendants argue that the term "jet reactor" contained in claim 1 of the '808 patent refers solely to the reactor shown pictorially and described as a "jet-type reactor" in an earlier Kearns patent application,[41] and cannot be construed to refer to any other forms of pipe reactors.

"The scope of every patent is limited to the invention described in the claims contained in it, read in the light of the specification." Motion Picture Patents Co. v. Universal Film Mfg. Co., 1917, 37 S.Ct. 416, 418. The claims of the patent in suit must therefore first be considered.

Claim 1 of the '808 patent describes the apparatus in which phosphoric acid and ammonia are contacted as a "jet reactor." There is, however, no pictorial representation of the device referred to, and the patent specification must be looked to for further guidance. There are two references to reactors in the specification. The first provides that "the reaction is carried out in a jet reactor such as that described in the U.S. application of T. C. Kearns, S.N. 444,595, the disclosure of which is hereby incorporated by reference."[42] The patent application incorporated by reference, now designated U.S. Patent No. 3,419,373,[43] discloses a method of producing monoammonium phosphate, a solid fertilizer. The claims of that patent describe the process reaction as occurring in a "reaction zone."[44] Also contained in the patent is a pictorial representation[45] of what the specification refers to interchangeably as "a two fluid reactor,"[46] "a jet-type

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[41] Plaintiff's exhibit 6.

[42] Plaintiff's exhibit 1 (col. 1, lines 47-50).

[43] Id.

[44] Id. (col. 7, line 34).

[45] See Appendix A.

[46] Plaintiff's exhibit 6 (col. 3, line 34).

reactor,"[47] "a two fluid nozzle jet-type reactor,"[48] and a "jet reactor."[49] The drawing shows a reactor (hereininafter the MAP reactor) consisting of a pipe with inlets for phosphoric acid and ammonia. The acid, H_3PO_4, is fed into the pipe through a large inlet and the ammonia NH_3, is supplied through a smaller inlet contained inside the larger inlet. At the point where both chemicals are contacted in the reactor, they are mixed by means of a vane having blades which impart a centrifugal motion to the acid stream.

The second reference to a reactor in the 808 patent specification describes the reactor more fully:

> "The apparatus used may comprise an elongated reactor pipe having a diameter less than its length and generally uniform in cross section, said reactor having an inlet end and outlet end. Inlet tubes are provided at the inlet end of the pipe for feeding ammonia and wet process acid into the pipe. These inlet tubes are connected to a source of supply exterior to the pipe. The inlet tubes can be positioned in spaced apart relationship if desired or positioned concentrically, one within the other. Usually, the inlet tube is merely an open end tube but orifices can be provided if desired, to obtain finer dissemination [18] of reactants. Also the inlet tube can be provided with a plurality of spaced openings, i.e., a manifold type.
>
> "One embodiment of an apparatus used to carry out the process for production of ammonium polyphosphates comprises a two fluid jet-type reactor set forth in the above-mentioned Kearns application. Specifically, this jet reactor consists in most cases of about 8 feet of ½ inch alloy 316SS pipe for the phosphoric acid. The gaseous ammonia enters the

[47] Id. (col. 3, line 56).

[48] Id. (col. 3, line 60).

[49] Id. (col. 4, line 31).

pipe in a 1/8 inch pipe positioned inside the ½ inch pipe. The length of the pipe was varied from 2 to 16 feet but no significant change in product was found."[50]

Defendants argue that the explicit incorporation by reference of the MAP reactor in the '808 specification necessarily limits the scope of the '808 patent to a process using that reactor.[51] Defendants contend that, except for the reference to the MAP reactor, nothing in the specification provides "clear support and antecedent basis . . . so that the meaning of the terms in the claims may be ascertainable by reference to the description.[52] They argue, therefore, that the meaning of "jet reactor" must under the rules of construction be limited to the MAP patent. I disagree.

A careful reading of the '808 patent specification demonstrates that although the MAP reactor is the preferred apparatus with which to carry out the disclosed process, it is not the only one. The passage of the specification which first refers to the MAP reactor states that the process is to be carried out in a jet reactor "such as" the MAP reactor. Further along in the specification, the MAP reactor is termed "one embodiment" of the ap-

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[50] Plaintiff's exhibit 1 (col. 4, lines 25-46).

[51] Defendants' expert witnesses, Richard A. Wahl and Robert Gottschalk, testified that the scope of the '808 patent was absolutely limited by the patent specification to the MAP reactor. It was the opinion of both men that the description of a reactor with inlet tubes spaced either concentrically or in a spaced apart relationship at column 4, lines 25-46 of the specification referred not to a "jet reactor", but to a conventional pipe reactor. In other words, both believed that '808 specification described two reactors. Defendants' other expert, Robert E. Isner, testified that he believed the passage at column 4, lines 25-46 of the specification did refer to a "jet reactor".

[52] Patent Office Rule of Practice 75(d).

paratus. These references clearly indicate that the MAP reactor is not the only apparatus which may be used, but merely an example of the type of reactor needed. Finally, the specification states that "[t]he inlet tubes can be positioned in spaced apart relationship if desired or positioned concentrically, one within the other." The drawing of the MAP reactor[11] (which was incorporated by reference into the '808 patent) shows an apparatus in which the inlet tubes are positioned concentrically, one within the other. Since the specification states that a "jet reactor" may have inlet tubes spaced apart or concentrically, it is apparent that the MAP reactor cannot be the sole embodiment of the "jet reactor" mentioned in claim 1. The claims of a patent need not be limited solely to a device described in the specification or depicted in a drawing. Ziegler v. Phillips Petroleum Company, 5 Cir. 1973, 483 F.2d 858, 177 USPQ 481; Arnold Pipe Rentals, Inc. v. Engineering Enterprises, Inc., 5 Cir. 1965, 350 F.2d 885 146 USPQ 622; Penn Yan Boats, Inc. v. Sea Lark Boats, Inc., S.D.Fla. 1972, 359 F.Supp. 948, 175 USPQ 260 affirmed, 5 Cir. 479 F.2d 1328, 178 USPQ 577, cert. denied, 94 S.Ct. 66, 179 USPQ 322.

Viewed against this background, therefore, the term "jet reactor" as used in the '808 patent is descriptive of a broad category of pipe reactors into which the reactants are introduced at great velocity, or "jetted." To limit its meaning solely to an apparatus such as the MAP reactor as urged by defendants would place a restriction on the patent not required by the claims or specifications.

Even if I were to adopt the restrictive construction of the '808 patent urged by defendants, I believe infringement would still exist under the judicially created doctrine of equivalents. Graver Tank Company v. Linde Air Products Company, 1950, 70 S.Ct. 854, 85 USPQ 328; Laser Alignment, Inc. v. Woodruff & Sons, Inc., 7 Cir. 1974, 491 F.2d 866, 180 USPQ 609; Ziegler v. Phil-

[11] See Appendix A.

lips Petroleum Company, 5 Cir. 1973, 483 F.2d 858, 177 USPQ 481; Phillips Petroleum Company v. Sid Richardson Carbon & Gasoline Company, 5 Cir. 1969, 416 F.2d 10, 163 USPQ 141; Great Lakes Carbon Corporation v. Continental Oil Company, W.D.La. 1963, 219 F.Supp. 468, 138 USPQ 613, affirmed, 5 Cir., 345 F.2d 145, 145 USPQ 513, cert. denied, 86 S.Ct. 241, 147 USPQ 540.

The infringement of a process patent cannot be avoided merely by making some minor variation in the apparatus used. Smith v. Snow, 1935, 55 S.Ct. 279, 24 [19] USPQ 26; CMI Corporation v. Metropolitan Enterprises, Inc., 10 Cir. 1976, 534 F.2d 874, 189 USPQ 770; Phillips Petroleum Company v. Sid Richardson Carbon & Gasoline Company, supra. Defendants do not contest the fact that the St. Rose process operates in the same manner under the same physical laws to produce the same result as the '808 patent. Rather, defendants argue that the crucial difference between the two lies in the substitution of a conventional tee reactor for the MAP reactor. The evidence, however, is overwhelming that it makes no difference in the process whether a MAP reactor or a tee reactor is used.[54] The only requirement is that the reactor used be of a type which will allow the short residence time necessary to make the process work; i.e., one where the reactants enter, and the reaction product exits, at high velocity. I find that the MAP reactor and the conventional tee reactor are equivalent apparatus and I reject the defense based upon the substitution of the tee reactor.

B. File Wrapper Estoppel

Defendants' second defense to infringement rests on another judicially created doctrine, file wrapper estoppel:

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[54] Research carried out by Ferguson and FFM demonstrates this fact. See plaintiff's exhibits 43, 45-49, 51, 204B, 206. Further evidence is supplied by the fact that Swift uses a tee reactor in commercial applications of the '808 patent.

"An invention is construed not only in the light of its claim [and specification] but also with reference to its file wrapper or prosecution history in the Patent Office." Ziegler v. Phillips Petroleum Company, supra, 483 F.2d at 870, 177 USPQ 488-489. Under the doctrine a patentee who amends or otherwise limits his claims in response to the objections of the patent office is estopped from later re-asserting them. Ziegler v. Phillips Petroleum Company, supra; Rosen v. Kahlenberg, supra. Defendants argue that the doctrine is applicable here to restrict the claims of the '808 patent to the use of the MAP reactor. While I agree that file wrapper estoppel is applicable here to a limited extent, I find that it does not negate defendants' infringement.

The '808 file wrapper[35] reveals that a series of amendments to the application were made in response to objections of the Patent Office The original claims[36] (claims 1 through 6) failed to specify any particular type of reaction apparatus. Claims 1 through 3 and 6 speak only of "reacting" phosphoric acid and ammonia, while claims 4 and 5 refer to a "reaction zone." Compared to a prior patent claims 1, 2 and 6 were rejected for lack of novelty[37] and claims 3 through 5 were rejected for obviousness.[38] In response to the rejection, Kearns' patent attorney filed an amendment which cancelled claims 1 through 6 and substituted new claims 7 through 12. Claims 7 and 9 again refer only to "reacting" the acid and ammonia, while claims 8 and 11 refer to a "restricted reaction zone." The term "jet reactor" appears for the first time in claim 12. The remarks to the amendment contain the following explanation:

> Generally speaking, the reaction is carried out in a jet reactor, not a reaction vessel of the Hignett type. The jet reactor may be of the type disclosed

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[35] Plaintiff's exhibit 2.

[36] Id. (pages 15-16).

[37] 35 U.S.C. §102.

[38] 35 U.S.C. §103.

in Serial No. 444,595, which application was recently been allowed and which disclosure has been incorporated by reference at page 5 of the instant specification.[59]

In rejecting these new claims, the patent examined stated:

> Claims 9-12 are rejected as unpatentable over Getsinger under 35 U.S.C. 103. Getsinger discloses a method similar to the one claimed except for the limitations on the size and shape of the reaction zone and the step of propelling the reaction product through space. The size and shape of the reaction zone are apparatus limitations and do not patentably distinguish the process claims from the reference.[60]

In response to this objection a second amendment to the application was filed. In this amendment, there is no mention of a "jet reactor," but new claims 13 and 14 state that the reaction occurs in a "restricted reaction zone."[61] In his remarks in support of the amendment, Kearns' attorney refers to the "instant pipe reactor"[62] Shortly after this second amendment was filed, the applicant filed a supplemental amendment[63] containing new claim 20, which became claim 1 of the patent. In support of the use of the term "jet reactor" in the claim, the remarks to the supplemental amendment state that the "[b]asis for the language jet reactor is [20] found at page 5, lines 26-28." Page 5, lines 26-28 reads: "[t]he reaction is carried out in a jet reactor such as that disclosed in U.S. Application of T. C. Kearns, S.N. 444,595, the disclosure of which is hereby incorporated by reference."

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[59] Plaintiff's exhibit 2 (page 26).

[60] Id. (pages 27-28).

[61] Id. (page 30-31).

[62] Id. page 37).

[63] Id. (pages 39-43).

Relying on the testimony of their expert witnesses,[a] defendants contend that the prosecution history of the '808 patent demonstrates a narrowing of the claims in regard to the apparatus to be used to carry out the process. They argue that the file wrapper shows the limitation of the reacting step in the following sequence: 1) reacting; 2) reacting in a reaction zone; 3) reacting in a restricted reaction zone; 4) reacting in a jet reactor.[b] They also contend that the remarks to the amendments filed in the Patent Office show that Kearns relied on the MAP reactor as a basis for the use of the term "jet reactor" in claim 20 (claim 1 of the patent). In short, they argue that the process "sold" to the Patent Office was one carried out with the MAP reactor and that Swift, having given up claim to a process using any reaction apparatus other than the MAP reactor, is now estopped from asserting that the '808 process could include the use of another type of reactor.

File wrapper estoppel does preclude Swift from arguing that the scope of the '808 patent is broad enough to encompass the use of the process with any reactor other than a "jet reactor." As defendants observe the reacting step in the '808 process was progressively limited from the general "reacting" to the more restrictive "reacting in a jet reactor." Moreover, this narrowing of the claim does appear indeed to have been undertaken in response to the objections of the Patent Office that the '808 process was unpatentable over prior patents which involved the use of tank or column reactors. Swift is estopped from arguing that its patent cover the use of these other reactors.

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[a] Defendants' experts, Wahl and Gottschalk, testified that the hierarchy of reactors can be classified in the following manner:

(GENIUS)		Reactor		
(SPECIES)	Tank Reactor	Pipe Reactor	Column Reactor	
(SUBSPECIES)	Jet Reactor			Tee Reactor

[b] See defendants' exhibit 71.

There is nothing in the file wrapper, however, which limits the meaning of "jet reactor" to the MAP reactor. It is true that the applicant cited the MAP reactor as a basis for its use of the term. However, these allusions are no different than the references to the MAP reactor in the final version of the '808 patent specification. For example, in the remarks accompanying the first amendment to the '808 application, the applicant states:

> Generally speaking, the reaction is carried out in a jet reactor, not a reaction vessel of the Hignett type. The jet reactor may be of the type disclosed in Serial No. 444,595, which application has recently been allowed and which disclosure has been incorporated at page 5 of the instant specification.[36]

This statement merely distinguishes the apparatus used in the '808 patent— a jet reactor—from the type used by Hignett— a tank reactor.[37] Furthermore, the applicant states that the jet reactor *may* be of the type disclosed in the MAP patent application. This language merely indicates that the MAP reactor is one of several possible embodiments of the "jet reactor;" nowhere does the applicant take the position that the MAP reactor is the *only* type of jet reactor he contemplates. Similarly, the applicant's reference in the supplemental amendment to the MAP reactor as the basis for his use of the term "jet reactor" merely indicates that the MAP reactor is one example of a "jet reactor."

"[Defendants] are protected by the file wrapper estoppel only if they can show that their alleged infringement is in an area to which the prior art could possibly have been thought to extend so as to make it impossible to make valid claims there, for there is no reason to presume applicant made a disclaimer broader than necessary to yield to the actual challenge to his claim." Hunt Tool Company v. Lawrence, 5 Cir. 1957, 242 F.2d 347,

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[36] Plaintiff's exhibit 2 (page 26).

[37] U.S. Patent No. 3,171,733. Defendants' exhibit 10.

354, 113 USPQ 7, 12-13. Here, the Patent Office challenge to Kearns' claim concerned the reaction step. The prior art upon which the challenge was based taught that the reaction between phosphoric acid and ammonia was carried out in a tank or column reactor. To overcome the challenge, Kearns specified that his process was to be carried out in a jet reactor, as opposed to these other two types. Having distinguished the reactors used in the relevant prior art, Kearns had no reason to further limit his invention to a particular jet reactor. I will not presume that he "made a disclaimer broader than necessary to yield to the actual challenge to his claim." Accordingly, the doctrine of file wrapper estoppel [21] does not shield defendants from the charge of infringement.

VII. FFM'S Liability

Since the process carried out at the Usamex plant at St. Rose infringes the '808 patent, Usamex may clearly be liable as an infringer. FFM's liability is less direct. Swift contends that although the infringing operations at St. Rose were carried out in the name of Usamex, this activity was induced, directed and controlled by FFM. Swift argues, therefore, that FFM should also be liable for the infringement. FFM, on the other hand, denies that it controlled the actions of Usamex or that it induced any infringement.

The federal patent law provides two bases of liability for direct infringement. First, one who "without authority makes, uses or sells any patented invention, within the United States during the term of the patent therefor, infringes the patent." 35 USC §271(a). Second, one who "actively induces infringement of a patent shall be liable as an infringer." 35 U.S.C. §271(b). Liability as an infringer under §271(a) hinges upon active participation in, or direct benefit from the infringement. Kinnear-Weed Corporation v. Humble Oil & Refining Company, S.D.Tex. 1969, 324 F.Supp. 1371, af-

firmed, 5 Cir. 441, F.2d 631, cert. denied, 92 S.Ct. 283. An inducer of infringement under §271(b), must aid and abet the infringement. Ingersoll-Rand Company v. Rockwell International Corporation, S.D.Fla. 1976, 420 F.Supp. 277.

I find that FFM is liable under either theory. The evidence is that FFM, from the time of its initial investigation of the Poly Actor Phase IV process to the time this lawsuit was filed, directly influenced and/or controlled the development of the process which is now carried out at St. Rose. Moreover, the evidence is overwhelming that FFM created Usamex solely to provide a United States market for its wet process phosphoric acid and controlled virtually every phase of the subsidiary's operation.

FFM first evidenced interest in Ferguson's PolyActor Phase IV process in the summer of 1969 while seeking to obtain a license to a process for producing liquid fertilizer directly from wet process phosphoric acid.[68] Tom V. Burns, a consultant employed by FFM, went to the Atchinson, Kansas pilot plant under instructions to observe the operation and take an active role in further development of the process.[69] Ferguson became aware that its process might infringe the '808 patent and, rather than face the possibility of litigation, decided to sell the process outright to a buyer who would agree to undertake the defense of the PolyActor Phase IV process.[70] From the moment that FFM first expressed interest in the process all information from the attorney prosecuting the Schenewerk patent application was directed to the attention of FFM, its chief executive officer J. R. Zerbst, and its technical director Ronald Fogg.[71]

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[68] Plaintiff's exhibits 31, 93, 205, 208.

[69] Plaintiff's exhibits 34, 35, 203, 211.

[70] Plaintiff's exhibits 32, 36, 206.

[71] Plaintiff's exhibits 41, 43, 44.

Under the supervision of Burns, the PolyActor Phase IV process had evolved into two separate processes. Process A, the original Schenewerk process, utilized a "vapor jet reactor." Process B utilized a conventional tee reactor. Because Swift owned a major customer of FFM, Zerbst preferred to avoid litigation with Swift over the process.[72] Zerbst requested and obtained a report from Robert E. Isner, the attorney prosecuting the Schenewerk application, stating that Process A might infringe the '808 patent but that Process B would not.[73]

After obtaining Isner's opinion, FFM joined with APCO Farm Chemicals, Inc. to form AMEX Fertilizers, Inc., a shell corporation set up merely to hold the patent on the PolyActor Phase IV process.[74] AMEX agreed to buy the process from Ferguson.[75] Thereafter, an agreement was entered into by AMEX, APCO, FFM and Ferguson[76] specifying that AMEX would sell the rights to the Ferguson process to APCO, which would then grant the right to manufacture the equipment used in the process to Ferguson. By the same instruments, FFM agreed not to take action in conflict with Ferguson's rights. However, APCO Farm Chemicals was subsequently sold by its parent company becoming Jon-T Chemical Company. At this point, FFM became disenchanted with the joint venture and formed Usamex. Zerbst became Usamex's president and the company's board of directors was comprised entirely of FFM officers and directors.[77] The agreement between Ferguson and Jon-T (as APCO's successor) was terminated[78] and FFM sold to

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[72] Plaintiff's exhibits 47-51.

[73] Plaintiff's exhibits 48, 49.

[74] Plaintiff's exhibit 201.

[75] Plaintiff's exhibit 53.

[76] Plaintiff's exhibit 55.

[77] Plaintiff's exhibits 57, 59, 60.

[78] Plaintiff's exhibit 62.

Usamex a complete PolyActor Phase IV plant in exchange for all of Usamex's stock, which had [22] a par value of $85,500.00.[79] At the same time, FFM extended Ferguson credit with Usamex for $85,500.00.[80] Ferguson then drew on this credit when it sold the equipment to Usamex.[81]

Throughout this episode of corporate juggling FFM was in control. FFM first investigated and agreed to purchase the Ferguson process. Under FFM's direction the process was modified and the Burns' patent application filed. FFM sought and obtained a legal opinion on the infringement issue. Finally, FFM formed one shell company to own the process and another to operate it. Indeed, officials of Ferguson testified that they considered FFM, AMEX and Usamex to be one entity since the decisions for all three companys were made by top management at FFM.[82] FFM's control did not end once operations began at the St. Rose plant. Financing, construction and operation of the St. Rose plant continued to be closely supervised and directed by the FFM management.[83] In sum, I find that FFM was directly responsible for the development and implementation of the process by Usamex at the St. Rose plant. Accordingly, I conclude that FFM is liable both as a direct infringer under 35 U.S.C. §271(a) and as an inducer of infringement under 35 U.S.C. §271(b).

VII. '808 Patent's Validity and Enforceability

To determine whether defendants have infringed the patent in suit, the patent's validity was assumed. I now examine that assumption in addition to defendants' charge that the patent is unenforceable because it was obtained by fraud on the Patent Office.

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[79] Plaintiff's exhibit 64.

[80] Plaintiff's exhibit 58.

[81] Plaintiff's exhibit 81.

[82] Plaintiff's exhibits 205, 208.

[83] Plaintiff's exhibits 66, 93, 99-101.

A. Validity of the Patent

"A patent shall be presumed valid . . . . The burden of establishing the invalidity of a patent or any claim thereof shall rest on the party asserting it." 35 U.S.C. §282. The presumption of validity "may be rebutted only by a quantum of proof—whether it be called clear and convincing or beyond a reasonable doubt—which is greater than a mere preponderance of the evidence. One who seeks to rebut the presumption bears a heavy burden." Harrington Manufacturing Company v. White, supra, 475 F.2d at 794, 177 USPQ at 293.

Defendants attack the validity of the '808 patent on two grounds. The first is the requirement of 35 U.S.C. §103 that a patented invention not be obvious to a person having "ordinary skill in the art." The second is that the claims of a patent point out distinctly and with particularity what the patentee regards as his invention. 35 U.S.C. §112.

1. Obviousness

> Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined. Such secondary considerations as commercial success, long felt but unsolved needs, failure of others, etc., might be utilized to give light to the circumstances surrounding the origin of the subject matter sought to be patented. As indicia of obviousness or nonobviousness, these inquiries may have relevancy.

Graham v. John Deere Company of Kansas City, 1966, 86 S.Ct. 684, 148 USPQ 459, 467.

Before examining the prior art cited by defendants, it will be helpful to narrow the search by ascertaining

which claims of the '808 patent are at issue. First Swift does not contend that the objects of the '808 patent are new. Rather, Swift claims to have found the solution to a problem which had been the subject of extensive research for a number of years, i.e., how to make high analysis self-sequestering liquid ammonium phosphate fertilizer directly from wet process phosphoric acid without dehydrating the acid into superphosphoric acid. Second, Swift does not contend that the use of a pipe reactor, is new. The area in which Swift does contend that the '808 patent is new and nonobvious involves the temperature and time variables involved in the process reaction. Claim 1 of the patent in suit describes a process of which phosphoric acid with a P_2O_5 content of between 54% and 68% is reacted with ammonia at a temperature of between 450°F. and 650°F. for a period of less than one second. Swift claims that the prescribed temperature range and residence time are critical in order to produce a high analysis, self-sequestering liquid fertilizer from phosphoric acid of the concentration noted. The focus of the examination of the prior art must be on these two variables.

[23] Defendants cite a number of patents and a 1964 TVA demonstration of a direct APP process in support of their contention that the '808 patent is invalid for obviousness. Each of these must be examined in turn.

U.S. Patent No. 2,755,176[24] (the Pearce patent) is a process and apparatus patent for the manufacture of dry fertilizer. The process disclosed consists of three steps, only one of which is relevant here. That step involves the reaction of an acid (which may be phosphoric acid) with ammonia in a 30 to 6 inch tee mixer and the propulsion by steam of the reaction product down a 10 foot pipe connected to the mixer. According to this patent, the fertilizer product and steam "may move through the lines at speeds approaching 500 feet per second." Be-

[24] Plaintiff's exhibit 7(d).

cause of the pipe used the residence time of the reaction product within the reactor is less than one second. With one exception, the temperature of the reaction is not critical. But when phosphoric acid is the acid reactant used "the prevailing temperature must be kept below 170°F. as a precaution against decomposition of the ammonium phosphate."

C.S. Patent No. 2,902,342[65] (the Kerley patent) also discloses a method and apparatus for manufacturing dry ammonium fertilizers by a three step process. The first step involves the prepartion of a phosphoric or other acid solution of between 45% and 55% P_2O_5. This acid is partially ammoniated in a tank reactor in the second step to further concentrate the acid and produce a hot slurry which is then pumped into a pipe reactor for the third step, the final ammoniation of the acid. This final reaction of phosphoric acid and ammonia is "carried out in a tubular converter at high linear velocity to expel a mixture of dry or nearly dry reaction product and water vapor or steam." "Usually about 15 seconds residence time in the tube is sufficient." According to the patent specification, these last two steps (partial ammoniation and final ammoniation) "may be combined and carried out as a single step in the tubular reactor."

U.S. Patent No. 2,950,960[66] (the Striplin patent) is a process patent disclosing a method for the production of liquid fertilizers from superphosphoric acid. By "introducing water, ammonia and superphosphoric acid into a reaction zone [in this case a tank reactor with agitation]; therein rapidly and intimately mixing them at a temperature in the range from 55°F to about 125°F . . ." a high analysis liquid fertilizer results without the formation of precipitates. The patent specifies, however, that the temperature "can go only a very little above 100°F when

[65] Plaintiff's exhibit 7(e).

[66] Defendants' exhibit 26.

stability for long periods is desired." A sample of fertilizer produced at a reaction temperature of 116°F. was stable, i.e., the impurities remained sequestered, for about only two weeks. In regard to the residence time of the product within the reactor, the patent states: "We have found that the reaction is very rapid, but a long mixing time may be used without any bad effects."

U.S. Patent No. 3,044,851[87] (the Young patent) is one of the first patents to disclose a method for producing a liquid, self-sequestering ammonium polyphosphate fertilizer from wet process phosphoric acid involving the concentration of the wet process acid before reaction with ammonia. Wet process phosphoric acid with a P_2O_5 content of 54% or less is first heated in a tank under pressure to a temperature of between 120°C and 400°C [248°F. and 752°F.] to convert about 50% of orthophosphates in the acid to polyphosphates. The concentrated acid is cooled and then introduced into a pipe where it is reacted with ammonia. As an alternative method, the patent suggests a method which seems strikingly similar to the '808 process.

> If desired, the ammonium phosphate can be prepared from the acid during or immediately after the heating, e.g., by passing anhydrous ammonia directly into the body of acid being heated. In this embodiment, the exothermic heat of reaction also supplies a portion of the heat to concentrate the acid.

To describe this alternative process more clearly, the patent refers to figure no. 8 in the specification,[88] which depicts a pipe reactor into which the wet process acid is introduced at one end. After passing through a section of the pipe that is heated, the acid is reacted with ammonia which is fed into the pipe through an inlet. The resulting liquid ammonium phosphate product then exits

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[87] Plaintiff's exhibit 7(g).

[88] See Appendix D.

through the other end of the pipe and is quenched with water. The residence time of the reaction product in the pipe is not specified.

U.S. Patent No. 3,171,733[89] and No. 3,288,752[90] (the Hignett patents) disclose a [24] method of producing liquid or dry fertilizer from superphosphoric or highly concentrated wet process phosphoric acid. The process disclosed involves the reaction of the acid with ammonia in a tank reactor with agitation "at elevated temperatures and pressures." The pressures range between 10 and 1000 pounds per square inch.

> The temperature in reactor 3 [a tank reactor] may be maintained in the range from about 325° to 475°, with the preferred temperature range being from about 350°F. Depending upon temperature and other variables, the retention time in reactor vessel 3 may range from about 10 minutes to 3 hours, the preferred retention time being in the range from about 1 to 1.5 hours. We have found that increasing the retention time increases the degree of ammoniation of the product.
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> • • • •
>
> It is apparent that there are several combinations of pressure, temperature and retention time which may be used to obtain a given degree of ammoniation. To obtain the highest degree of ammoniation high pressure, low temperature and long retention time should be used.

U.S. Patent No. 3,375,063[91] (the Bookey patent) discloses a method of producing dry fertilizer by reacting wet process phosphoric acid and ammonia in a column reactor. Ammonia gas and phosphoric acid containing be-

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[89] Defendants' exhibit 10.

[90] Defendants' exhibit 33.

[91] Defendants' exhibit 11.

tween 45% and 56% P_2O_5 are fed into a column reactor containing ammonium polyphosphate maintained at between 170°C and 250°C [338°F. and 482°F.]. The fertilizer product is withdrawn from the bottom of the reactor. The patent claims fail to specify a residence time for the process, but in example 1, wheree 50% wet process acid was reacted with ammonia at about 170°C [338°F.], the residence time was one hour.

U.S. Patent No. 3,382,059[32] (the Getsinger patent), developed in 1964, was the subject of a TVA demonstration[33] in October of that year. The patent discloses a method of producing self-sequestering liquid fertilizer by reacting wet process phosphoric acid and ammonia in a tank reactor. The wet process acid is first partially neutralized with ammonia in a scrubber tank and then fed with ammonia into a reaction tank where the heat of reaction is used to concentrate the acid and convert orthophosphates into polyphosphates. By using the heat of reaction to concentrate the acid, this patent claims that "the previously required separate step of concentrating said wed process phosphoric acid up to the range of super phosphoric acid is entirely eliminated."

> Further, I have found that, in carrying out my process for the manufacture of liquid . . . fertilizers by the ammoniation of wet process phosphoric acid, I can utilize the free heat of ammoniation of evaporate water and thereby condense the acid rather than require the use of expensive heat from fuel. My process accomplishes the two functions of ammoniation and concentration simultaneously instead of using two separate processes.

The Getsinger process utilizes three variables: temperature, retention time and pressure. The limits and preferred ranges for these variables are listed in the patent

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[32] Defendants' exhibit 9.

[33] Plaintiff's exhibit 128A.

specification: Temperature limits are 300°F. to 600°F., with a preferred range of 400°F. to 500°F.; retention time limits are 1 to 180 minutes, with a preferred range of 2 to 30 minutes; the pressure limits are .5 to 1000 pounds per square inch, with a preferred pressure of 80 pounds per square inch. The specification also states that "[w]hen the product is to be used in making liquid fertilizer, the retention time in the reactor is limited by the amount of impurities (particularly iron and aluminum) in the acid. At long retention times, unsequestered solids are formed by the impurities." In the five examples provided in the specification, the retention times ranged between 5 and 22 minutes and the temperatures ranged between 425°F. and 470°F.

Defendants argue that, in light of these patents, it was obvious for Kearns to use a reaction temperature of between 450°F. and 650°F. and a residence time of less than one second. They contend that the use of this temperature range and residence time were disclosed in these other patents and that Kearns' accomplishment was merely to put together what others had already discovered. While I agree that Kearns temperature range and residence time were used by others, I do not agree that it was obvious for Kearns to combine the two variables in the manner that he did to produce the results that he achieved.

The prior art did teach that longer reaction residence times were inimical to the effective sequestration of metal solids in liquid fertilizers produced from ammonia and phosphoric acid. The Getsinger patent advised [25] that long retention times should be avoided.[24] A TVA demonstration booklet[25] published in October, 1964 also indicated that increasing the retention time tended to decrease the rate of phosphate conversion from the ortho form to the poly form when wet process acid containing

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[24] Defendants' exhibit 9; see also defendants' exhibit 34.

[25] Plaintiff's exhibit 128A (page 40).

a large amount of impurities was used. Furthermore, the Pearce patent disclosed a process which actually utilized a residence time of less than one second.[96] Defendants argue that in light of the Getsinger and Pearce patents it was obvious for Kearns to utilize the less than one second residence time.

I disagree. The Pearce patent involved only the production of solid, not liquid, fertilizers. Moreover, none of the processes which were developed after the Pearce patent, except for the '808 process, placed any importance on the use of such an extremely short retention time. Pearce filed his patent application in 1952 and the patent issued in 1956. Eight years later, however, Getsinger and TVA were still using a tank reactor with a preferred residence time of 2 to 30 minutes. Others working in the field were even further away from using residence times of under one second. The Hignett patent advised increasing the retention time to increase the degree of ammoniation. The Striplin patent "found that the reaction is very rapid, but a long mixing time may be used without any bad effect." The Young patent, with its alternative process similar to the '808 process, and the Bookey patent apparently placed no importance at all on the length of the residence time, for neither of them specified a range of times.[97] Only Kerley, whose patent application was filed in 1955, used a residence time even close to one second. That patent specified that "[u]sually about 15 seconds residence time in the tube is sufficient."

Only after TVA had obtained a copy of Swift's French patent on the Kearns process in 1968 did its focus switch

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[96] While Pearce did not specify the residence time employed in his process, he did indicate that the reaction product moved through a ten foot pipe reactor at "speeds approaching 500 feet per second." Using these figures, a residence time of under one second can be computed.

[97] The Bookey patent did specify a one hour residence time in one example of its processes.

from the Getsinger tank process to a process using a pipe reactor with a residence time measured in seconds. The TVA demonstration booklet published in October, 1968, stated: "After bench-scale tests showed that high citrate solubility levels of the P_2O_5 could be consistently obtained when using a tee mixer, the pilot plant was converted to this type of operation. Using the tee reactor in this manner gives a high degree of mixing and comparatively short retention time by taking advantage of the kinetic energy and chemical energy of the reactants and the frictional forces in the pipe."[28] A 1970 TVA report on pilot plant studies of the TVA direct process echoed this discovery.

> In the early phases of the work it was determined in bench-scale and pilot-plant tests that the retention time in the second-stage reactor must be limited to a maximum of two minutes to avoid the formation of excessive amounts of citrate-insolube phosphates when using a phosphoric acid with an $R_2O_3:P_2O_5$ mole ratio greater than about 0.03. With the use of the tee reactor as the second stage, the retention time was very short and the problem of the formation of nitrate-insoluble phosphates was eliminated."[29]

The fact that TVA, the dominant force in liquid fertilizer research, did not assert the importance of the extremely short residence time used by Kearns until after obtaining the French patent is a "secondary consideration" which strongly suggests that it was not obvious from the prior art to use a short residence time.

The '808 patent specifies that a temperature of 450°F. to 650°F. must be used to ensure conversion of at least 20% of the phosphate contained in 54% to 68% phosphoric acid. Other researchers agree that reaction temperature range is critical to the production of a liquid

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[28] Plaintiff's exhibit 128C (page 57).

[29] Plaintiff's exhibit 127 (page 7).

product in which the impurities are effectively sequestered. For example, in a 1970 publication, TVA reported the following:

> The proportion of polyphosphate obtained in the melt was almost entirely dependent on the reaction temperature in the tee. The effect of temperature in the tee reactor on polyphosphate formation is shown in the following tabulation.

[26]

Test No.	Tee reactor temp., °F.	Polyphosphate content, % of total P_2O_5
230-4	412	27
237-4	446	41
237-3	456	45
238-1	465	48[100]

Defendants contend that the use of a temperature range from 450°F. to 650°F. in the '808 patent was obvious in light of the Getsinger patent. Essentially, defendants contend that the '808 patent is a combination patent, that is, one which merely put together knowledge that had already been disclosed by the prior art, specifically the temperature range of the Getsinger patent and the residence time of the Pearce patent. Combination patents are to be viewed with especially strict scrutiny.

> The conjunction or concert of known elements must contribute something; only when the whole in some way exceeds the sum of its parts is the accumulation of old devices patentable. Elements may, of course, especially in chemistry or electronics, take on some new quality or function from being brought into concert, but this is not a usual result of uniting elements old in mechanics.

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[100] Id. (pages 9-10).

> Courts should scrutinize combination patent claims with a care proportioned to the difficulty and improbability of finding invention in an assembly of old elements. The function of a patent is to add to the sum of useful knowledge. Patents cannot be sustained when, on the contrary, their effect is to subtract from former resources freely available to skilled artisans.

Great Atlantic & Pacific Tea Company v. Supermarket Equipment Corporation, 1950, 71 S.Ct. 127, 130, 87 USPQ 303, 305-306. See also Proler Steel Corporation, Inc. v. Luria Brothers & Company, Inc., 9 Cir. 1969, 417 F.2d 272, 163 USPQ 321; Spray-Bilt, Inc. v. Ingersoll-Rand World Trade, Ltd., 5 Cir. 1965, 350 F.2d 99, 146 USPQ 686.

Even if the '808 patent is a combination patent, I find that it is valid. First, the prior patents deal with different reactions, involving different problems and the achievement of different objectives. The Pearce process employs a "relatively subdued reaction" of acids with ammonia to produce a dry fertilizer. Because Pearce was unconcerned with the conversion of orthophosphates to polyphosphates, temperature, with one exception, was not criteral. The Getsinger process on the other hand, involves manufacture of liquid rather than solid fertilizer, a process in which the degree of phosphate conversion is of the utmost importance. While Pearce warned against a highly exothermic reaction, Getsinger actually required such a reaction in order to convert orthophosphates by polyphosphates. The two patents are, therefore, on this point antithetical. To view the '808 patent now as a mere combination of the Getsinger and Pearce patents would be to submit to "the temptation to read into the prior art the teachings of the invention in issue." Graham v. John Deere Company of Kansas City, supra, 86 S.Ct. at 703, 148 USPQ at 474. As the Fifth Circuit said in Bryan v. Sid W. Richardson, Inc., supra, 254 F.2d at 194, 117 USPQ at 159-160:

a combination whether composed of all old, or some old and some new elements, is patentable if it achieves an altogether new and useful result. Cameron Iron Works, Inc. v. Stekoll, 5 Cir., 242 F.2d 17, 112 USPQ 411; Robertson Rock Bit Co. v. Hughes Tool Co., 5 Cir., 176 F.2d 783, 82 USPQ 339. The life of such a combination is not to be destroyed by excision of its several parts without benefit of anaesthesia, nor is the cause of its vitality to be discovered by the prosecutor's retrospective dissection. Jeoffroy Mfg., Inc. v. Graham, 5 Cir., 206 F.2d 772, 776, 98 USPQ 424, 427-428.

"Secondary considerations" which "give light to the circumstances surrounding the origin of the subject matter sought to be patented" further support a finding of nonobviousness. Graham v. John Deere Co. of Kansas City, supra, 86 S.Ct. at 694, 148 USPQ 467-468. The '808 patent clearly provided an answer to a problem which others had failed to solve. Prior to Kearns' invention, the level of skill in the pertinent art had not progressed beyond the Getsinger process as practiced by TVA. TVA's experience with the Getsinger process, however, was far from a total success. TVA first demonstrated the process in October, 1964.[101] The next demonstration,[102] two years later, revealed that several problems had yet to be solved. TVA reported that "[o]ne of the main processing problems has been the formation of citrate-insoluble P_2O_5 in the product when wet-process acid [27] with a R_2O:P_2O_5 mole ratio in excess of about 0.04 is used in production of products with 30% or more of the phosphates as polyphosphates"[103] and further warned that "[w]hen feed acids with high proportions of R_2O compounds are used, the 10-34-0 product liquid fertilizers

[101] Plaintiff's exhibit 128A.

[102] Plaintiff's exhibit 128B.

[103] Id. (page 70).

contain large proportions of insoluble solids."[104] Nowhere in its demonstration booklet, however, did TVA indicate that the length of the reaction retention time would affect the formation of insoluble solids or that it was experimenting with variations in the retention time.

The first indication given by TVA that retention times might be critical to the success of the process was contained in the 1968 demonstration booklet.[105] By this time, some four years after its adoption of the Getsinger process, TVA reported that "most of the potential problems have been resolved. The process appears to have considerable versatility and is at a stage of development that would allow consideration of design of commercial-scale installations."[106] At this point, TVA had also modified the original Getsinger process and was using a tee reactor in the reaction stage. The booklet went on to report that the problem of citrate insolubles had been solved by converting to the use of a tee reactor with low retention time.[107]

The experience of defendants also demonstrates that Kearns' discovery was not obvious to those skilled in the art. Even after Ferguson and FFM had the '808 patent in front of them and had witnessed the 1968 TVA demonstration, they did not immediately recognize the importance of a residence time of less than one second. The plant-scale operation established in 1969 at Atchinson, Kansas was unable to manufacture a product of acceptable quality.[108] None of the Ferguson or FFM employees working on the process at that time believed that resi-

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[104] Id. (page 71).

[105] Plaintiff's exhibit 128C.

[106] Id. (page 54).

[107] Id. (page 57).

[108] Plaintiff's exhibits 66, 70, 208, 215.

dence time was a crucial element in the process.[109] Success was achieved only after the original Schenewerk process had been modified in late 1970 to utilize a reaction time of under one second.[110]

Kearns discovered in 1964 that citrate-insolubles can only be avoided by incorporating a residence time of under one second. This same conclusion was reached by TVA only after four years of research, and by defendants only after an additional three years. Clearly, Kearns' discovery was not obvious to TVA and to the defendants; on the contrary after substantial exploration did Kearns' alternative reveal itself.

2. Indefiniteness

The second paragraph of 35 U.S.C. §112 provides:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the application regards as his invention. A claim may be written in independent or dependent form, and if in dependent form, it shall be construed to include all the limitations of the claim incorporated by reference into the dependent claim.

Defendants contend that the claims of the '808 patent are not set out with the specificity required by §112, and, therefore, that the patent is invalid for indefiniteness. They argue that the claims are indefinite in two respects: first, the type of reactor to be used, and second, the time the reactants remain in the reactor.

a. Type of Reactor

Defendants argue that the use of the term "jet reactor" in claim 1 of the '808 patent is vague and ambiguous

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[109] Plaintiff's exhibits 208, 213, 215. Burns' initial report to FFM on the plant scale operation at Atchinson estimated the residence time to be about 30 seconds.

[110] Plaintiff's exhibits 68-70, 75-77, 204A, 204B. 208, 213.

and does not satisfy the degree of definiteness required by §112. Essentially, this argument is an extension of the position taken by defendants' supra, that the term "jet reactor" can refer only to Kearns' earlier MAP reactor. Defendants contend that the term in isolation is vague and therefore, reference must be made to the specification for a definition. Looking to the specification, they contend that the only definition revealed is the incorporation by reference of the MAP reactor. Therefore, if, as I have found supra, the term "jet reactor" was not intended to be limited solely to the MAP reactor, failure to explicitly state this fact makes the use of the term indefinite.

This argument is based on a false assumption. Contrary to defendants' position that the specification supplies meaning to the term "jet reactor" only by reference to the MAP patent, I have found supra, that the specification describes the MAP reactor as being only one of several possible embodiments of the reactor to be used in the process. The specification clearly states that [28] the reactor may have concentrically spaced inlet tubes, as with the MAP reactor, or the tubes may be positioned in a spaced apart relationship, as with conventional tee reactor. Furthermore, as discussed above the use of the descriptive term "jet" is well established in the art of pipe reactors used to manufacture ammonium polyphosphate fertilizers. The use of the term in the '808 patent, therefore, is not so vague and ambiguous that one with ordinary skill in the art of the manufacture of ammonium polyphosphate fertilizer would be uncertain of the scope of the patent.

b. Time in the Reactor

Defendants' argue that the phrase "contacting said stream of ammonia with said stream of phosphoric acid . . . for a period of less than one second" is unclear because the reaction of ammonia and phosphoric acid occurs instantaneously. "In other words, in all the prior art pro-

cesses for the production of ammonium polyphosphates, the ammonia and phosphoric acid always are in contact for less than one second which is all the time needed to complete reaction. How then does the defined contacting time distinguish the claimed process from contacting time of the prior art?"[111]

I find this argument to be totally without merit. It is true that the reaction of a molecule ammonia with a molecule of phosphoric acid can be considered to occur instantaneously.[112] Prior art reveals, however, that the "contacting" of the reactants for a period of less than one second refers not to the speed of the molecular reaction, but to the time reqiured to adequately mix the reactants. For example, the Getsinger patent specifies a retention time of 1 to 180 minutes in order to assure a complete reaction between the ammonia and phosphoric acid. The Kerley patent, which utilizes a tee reactor that allows better mixing of the reactants in a shorter period of time, specifies a residence time within the reactor of only 15 seconds. Certainly, defendants do not contend that these patents are invalid because they do not define "retention time" or "residence time". The extremely short residence time specified in the '808 patent is one of the grounds upon which it is distinguished from the prior art in the field of manufacturing liquid ammonium polyphosphate fertilizers. The '808 patent avoids the problem of unsequestered solids in the fertilizer product caused by overheating by retaining the product in the reactor for less than one second. Clearly, the length of the retention or residence time wtihin the reactor is a variable which was recognized in the prior art and a valid basis for distinguishing the '808 patent. I conclude, therefore, that the phrase "contacting said stream of ammonia with said stream of phosphoric acid . . . for a period of less than one second" is sufficiently

[111] Defendants' Post-Trial Brief, page 81.

[112] Testimony of Everett N. Mortenson.

definite to allow one with ordinary skill in the art of manufacturing liquid ammonium polyphosphate fertilizers to carry out the process disclosed in the patent without undue experimentation. See Ansul Co. v. Uniroyal, Inc., 2 Cir. 1971, 448 F.2d 872, 169 USPQ 759, cert. denied, 92 S.Ct. 680, 172 USPQ 257.

B. Fraud on the Patent Office

Defendants charge that, in its prosecution of the '808 patent, Swift committed fraud on the Patent Office by willfully withholding relevant prior art from the examiner, in particular, by failure to cite the Pearce patent. If the charge were substantiated, the patent would be invalid and unenforceable. Park v. Motorola, Inc., 5 Cir. 1975, 524 F.2d 518, 188 USPQ 225; Beckman Instruments, Inc. v. Chemtronics, Inc., 5 Cir. 1970, 439 F.2d 1369, 165 USPQ 355. I find, however, that defendants have failed in their proof.

An applicant for a patent has an "uncompromising duty" to disclose to the Patent Office all prior art which the applicant has reason to believe may be material to the patentability of his invention. Precision Instrument Mfg. Co. v. Automotive Maintenance Machine Co., 1945, 65 S.Ct. 993. While the type of misconduct before the Patent Office which will constitute fraud varies with the facts of each case, there must be "some element of wrongfulness, willfulness, or bad faith . . ." Park v. Motorola, Inc., supra, 524 F.2d at 535, 188 USPQ at 238-239. Furthermore, it must be established that the patent would not have issued but for the wrongful conduct. Eltra Corp. v. Basic, Inc., N.D. Ohio 1977, 193 USPQ 426. Finally, the fraud must be established by clear unequivocal and convincing evidence. Schnadig. Corp. v. Gaines Mfg. Co., Inc., 6 Cir. 1974, 494 F.2d 383, 181 USPQ 417.

It is undisputed that Swift had knowledge of the Pearce patent and did not cite it as prior art to the Patent Office. The existence of fraud which would invalidate the

'808 patent, therefore, turns on two issues. First, was the failure to cite Pearce material to the decision of the Patent Office to grant the patent? Second, in failing to cite Pearce, did [29] Swift act wrongfully, willfully, or in bad faith? I find the answers to both questions to be no.

The Pearce patent and its relation to the process disclosed in the patent in suit is discussed supra. Pearce discloses a method of manufacturing a dry fertilizer product by reacting ammonia and phosphoric acid in a pipe reactor. Furthermore, the process described in the patent specification involves a residence time within the reactor of less than one second. Defendants contend that, because Pearce is the sole example of prior art which involves the reaction of ammonia and phosphoric acid in a pipe reactor for a period of less than one second, ite relevance and materiality to the Patent Office's consideration of the patent in suit is undeniable. While I agree that the Pearce patent is relevant to the '808 patent, I find that Swifts' failure to disclose the patent during the prosecution of the '808 patent was not material to the decision of the Patent Office to grant the '808 patent.

The relevance of Pearce to the '808 patent is clear from the discussion of both patents on the issue of obviousness. Both patents deal with the reaction of ammonia and phosphoric acid in a pipe reactor to produce fertilizer. Moreover, one of the factors upon which the '808 patent relies to distinguish it from the prior art, a residence time within the reactor of less than one second, is also disclosed in Pearce. I believe, therefore, that it should have been cited to the Patent Office by Swift. At the same time, however, I find that the failure of Swift to cite the Pearce patent, had no material effect on the decision of the Patent Office to grant the '808 patent because, even in light of Pearce, I find that the '808 patent is patentable over the prior art.

Apart from the issue of materiality, I find no evidence that Swift's failure to cite Pearce was motivated by an "element of wrongfulness, willfulness, or bad faith." For example, in Beckman Instruments, Inc. v. Chemtronics, Inc., supra, fraud on the Patent Office was found because the evidence in that case demonstrated that, although the patentee recognized that a prior invention seriously threatened the patentability of its own invention, it not only failed to disclose the prior invention, but made affirmative representations to the Patent Office that there had been no previous inventions displaying the properties that the patented invention had in common with the earlier invention. Here, the evidence at most shows only that Swift failed to cite a prior patent which it should have cited. While such conduct is not to be condoned, where it has no material effect on the decision of the Patent Office and has not been shown to have been done willfully or in bad faith, it does not constitute grounds for invalidating the patent. Parker v. Motorola, Inc., supra; Beckman Instruments, Inc. v. Chemtronics, Inc., supra.

IX. Increased Damages And Attorneys' Fees

A. Increased Damages

The award of damages for patent infringement is governed by 35 U.S.C. §284:

> Upon finding for the claimant the court shall award the claimant damages adequate to compensate for the infringement but in no event less than a reasonable royalty for the use made of the invention by the infringer, together with interests and costs as fixed by the court.
>
> When damages are not found by a jury, the court shall assess them. In either event, the court may increase the damages up to three times the amount found or assessed.

> The court may receive expert testimony as an aid to the determination of damages or of what royalty would be reasonable under the circumstances.

Although the issue of quantum has not yet been tried, Swift urges the entry of a finding which would support the increase, under the second paragraph of §284, of whatever damages are ultimately assessed.

Damages may be increased under §284 in the court's discretion where the infringement is found to be intentional, willful and deliberate. Dow Chemical Co. v. Chemical Cleaning, Inc., 5 Cir. 1970, 434 F.2d 1212, 167 USPQ 513, cert. denied, 91 S.Ct. 1621, 169 USPQ 528. The burden of proving conduct that would justify the imposition of increased damages is on plaintiff. Columbia Broadcasting System, Inc. v. Zenith Radio Corp., N.D. Ill. 1975, 391 F.Supp. 780, 185 USPQ 662.

Swift contends that infringement of the '808 patent was willful and intentional. Swift charges that FFM agreed, through its subsidiary, AMEX, to purchase the process before investigating infringement. Then, in order to obtain a legal opinion of noninfringement, FFM decided to use a tee reactor with opposed inlet tubes rather than a reactor with concentric inlets. To obtain the opinion, Swift claims that FFM led Robert Isner, the patent attorney, to believe that the reactor was not an elongated pipe," as described in the '808 patent and that the residence time in the reactor was more than one second. Therefore, Isner's opinion of [30] noninfringement was based upon misrepresentations by FFM.

In addition to the Isner opinion, Swift contends that several other factors demonstrate the infringement was willful and intentional. These other factors include defendants' continuing reliance on the untenable position that changing the location of the inlet tubes in the reactor would avoid infringement, the aborted attempt to interject a new defense at trial based on one witness's testimony that the residence time of the reactor at St. Rose is greater than one second, the continuing refusal of

FFM to admit, in the face of overwhelming evidence, that it directed and controlled the infringing activities of Usamex at St. Rose, and defendants' failure to fulfill their promise to produce "considerable evidence" at trial in support of their contention that the '808 patent is invalid and unenforceable.

While I believe there is some evidence to support Swift's position that the infringement was intentional and willful, I find that Swift has failed to show such bad faith as would justify increasing the damages. Clearly, defendants' infringement was intentional in the sense that they were aware that their attempt to distinguish their process solely on the basis of the positioning of the reactor inlets was precarious. While defendants' position regarding the infringement issue was weak, I believe the issues concerning the validity of the patent, especially the question of obviousness, were open to debate. The evidence of defendants' conduct in connection with Isner's opinion of noninfringement also falls short of supporting a finding of bad faith. The evidence does show that FFM was anxious to obtain Isner's opinion so that it could present it to Swift and that when it was obtained, little was done to ensure that it was correct. However, I fail to find evidence which demonstrates that FFM deliberately misrepresented the facts to Isner.

Swift's complaints concerning defendants' interjection of a new and baseless defense at trial, their refusal to admit, in response to pre-trial requests for admissions, that FFM controlled the infringing activities of Usamex, and their failure to produce considerable evidence regarding the validity and enforceability of the patent in suit do not go to the issue of increased damages. They may, however, support other remedies, such as the awarding of costs under the Federal Rules of Civil Procedure and the awarding of attorney fees under 35 U.S.C. §285, infra.

B. Attorney Fees

"The court in exception cases may award reasonable attorney fees to the prevailing party." 35 U.S.C. §285. Swift contends that this is an "exceptional case" which justifies the award of fees.

While the imposition of increased damages under §284 and the award of attorney fees under §285 do not raise identical questions, Livesay Window Co. v. Livesay Industries, 5 Cir. 1958, 251 F.2d 469, 116 USPQ 167, the considerations underlying both remedies are similar. Attorney fees can be assessed only upon a finding of unfairness, bad faith, or inequitable or unconscionable conduct. Uniflow Mfg. Co. v. King-Seeley Thermos Co., 6 Cir. 1970, 428 F.2d 335, 166 USPQ 70, cert. denied, 91 S.Ct. 245, 167 USPQ 705; Purer & Co. v. Aktiebolaget Adde, 9 Cir. 1969, 410 F.2d 871, 161 USPQ 270, cert. denied, 90 S.Ct. 90, 163 USPQ 704. Furthermore, the offending conduct must be such that it would be grossly unfair for the prevailing party to bear the burden of its own attorney fees. Purer & Co. v. Aktiebolaget Adde, supra. The award of attorney fees in patent litigation is the exception, not the rule. Uniflow Mfg. Co. v. King-Seeley Thermos Co., supra; Borden, Inc. v. Occidental Petroleum Corp., S.D. Tex. 1974, 381 F.Supp. 1178, 182 USPQ 472.

I believe that this case is an "exceptional" one which supports assessment of attorney fees against defendants. Although the evidence does not clearly show that defendants' infringement of the '808 patent was deliberate and in bad faith, it does establish some degree of inequitable conduct on their part.

First, defendants attempt at mid-trial to interject a new defense which was not listed in the pre-trial order was, at the least, unfair. The defense was based on an ex parte experiment made by defendants' witnesses, Mustian and Slack, at the St. Rose plant. Mustian testified that from a test run made at St. Rose, he determined that, although the residence time of the steam in

the reactor was less than one second, the residence time of the molten ammonium polyphosphate product was actually greater than one second. When the operating conditions of this ex parte experiment were challenged, defendants dropped this defense and did not call the second witness who was to testify regarding the test run. Defendants attempt to foist this obviously groundless defense on the court and plaintiff in the midst of the trial must be taken as an indication of their bad faith.

Second, defendants' refusal to admit in response to plaintiff's request for admissions that FFM directed and controlled Usamex's alleged infringing activities needlessly [31] wasted the time of both plaintiff and the court. The evidence of FFM's involvement in and direction of Usamex's infringement of the '808 patent was overwhelming. To require plaintiff to present this otherwise superfluous evidence at trial was to act in bad faith.

When these two examples of inequitable conduct on the part of defendants are considered along with the weakness of defendants' reactor defense, a pattern of unconscionability emerges. Considering the case as a whole, I find that it would be unfair for Swift to bear the burden of its own attorney fees. I find, therefore, that this is an "exceptional case" in which reasonable attorney fees should be paid by defendants.

X. Findings of Fact And Conclusions Of Law

A. Findings of Fact

1. This court has jurisdiction over this action for infringement of a United States patent, under 28 U.S.C. §1338. Venue in the Eastern District of Louisiana is not disputed.

2. The process used by Usamex at St. Rose, Louisiana is identical to the process disclosed by claims 1-4 of U.S. Patent No. 3,464,808 and amounts to an infringement of the Swift '808 patent.

3. The scope of the term "jet reactor," as it appears in claim 1 of the patent in suit, is sufficiently broad to include all pipe reactors into which the reactants are fed at high velocity or "jetted."

4. Reactors with concentric inlet tubes, such as the MAP reactor, and reactors with inlet tubes positioned in a spaced apart relationship are equivalent devices when used in the manufacture of ammonium polyphosphate from wet process phosphoric acid.

5. The file wrapper of the '808 patent reveals that during the prosecution of the patent, the applicant limited his claims regarding the type of reactor to a "jet reactor," as that term is defined in finding of fact no. 3, supra.

6. FFM actively participated in, and directly benefited from Usamex's infringement of the '808 patent. In addition, FFM aided and abetted Usamex in its infringing activities.

7. The specification of the '808 patent that ammonia and wet process phosphoric acid are to be reacted at a temperature of between 450°F. and 650°F. for a period of less than one second would not have been obvious to one possessing ordinary skill in the art of manufacturing liquid ammonium polyphosphate fertilizer.

8. Although both a reactor residence time of less than one second and a reaction temperature range of 450°F. to 650°F. were variables known in the prior art, their combination in the '808 patent produced an unexpected, new and useful result.

9. The use of the term "jet reactor" and the phrase "contacting said stream of ammonia with said stream of phosphoric acid . . . for a period of less than one second" in claim 1 of the '808 patent are sufficiently definite to enable one skilled in the art to determine the scope of the patent.

10. Secondary considerations, such as the success of the '808 patent where others had failed and its fullfilment of an existing need support a finding that the '808 patent was nonobvious over the prior art.

11. Although Swift had a duty to disclose the Pearce patent to the patent office in the prosecution of the '808 patent, its failure to do so was not in bad faith and had no material effect on the decision of the Patent Office to issue the patent.

12. Swift has failed to prove that defendants' infringement of the '808 patent was deliberate, willful and in bad faith.

13. Defendants' conduct both prior to trial and during trial demonstrates a pattern of inequitableness and lack of fairness that makes it unfair for Swift to bear the expense of its attorney fees.

B. Conclusions of Law

1. Jurisdiction exists under 28 U.S.C. §1338 and venue is proper in the Eastern District of Louisiana.

2. Claims 1-4 of the '808 patent are directly infringed by operation at the Usamex plant located at St. Rose, Louisiana. 35 U.S.C. §271(a).

3. Swift is not estopped to assert that claims 1-4 of the '808 patent are infringed by the accused process practiced at the Usamex plant at St. Rose.

4. By actively participating in, and benefitting from, the infringement of the '808 patent by Usamex, FFM is liable as a direct infringer. 35 U.S.C. §271(a).

5. By aiding and abetting Usamex's infringement of the '808 patent, FFM is liable as an inducer of infringement. 35 U.S.C. §271(b).

6. Defendants failed to overcome the presumption that the '808 patent is valid and enforceable. 36 U.S.C. §282.

7. The invention disclosed in the '808 patent is a new and useful process which [32] satisfies the requirements of 35 U.S.C. §101 and §102.

8. The invention disclosed in the '808 patent would not have been obvious at the time the invention was made to a person having ordinary skill in the art to which it pertains. 35 U.S.C. §103.

9. The '808 specification concludes with claims which particularly point out and distinctly claim the subject matter which the applicant regarded as his invention and satisfies the requirement of 35 U.S.C. §112.

10. During the prosecution of the '808 patent, the applicant did not perpetrate fraud on the Patent Office.

11. Because plaintiff failed to show that defendants' infringement of the '808 patent was willful, deliberate and in bad faith this is not an appropriate case in which to increase plaintiff's damages under 35 U.S.C. §284.

12. Plaintiff has shown that this is an exceptional case under 35 U.S.C. §285 and plaintiff will be awarded reasonable attorney fees in accordance with that section of the Patent Laws.

APPENDIX D

[1343] 490 F.Supp. 1343

SWIFT CHEMICAL COMPANY

vs.

USAMEX FERTILIZERS, INC. et al.

Civ. A. Nos. 74-76 "G", 79-812 "G".

United States District Court,

E. D. Louisiana.

June 6, 1980.

[1344] • • •

[1345] Sear, District Judge.

Swift Agricultural Chemical Corporation (Swift) filed an action against Fertilizantes Fosfatados Mexicanos, S. A. (FFM) and its wholly owned subsidiary, Usamex Fertilizers, Inc. (Usamex), for infringement of a patent on the manufacture of liquid ammonium polyphosphate fertilizer, U.S. Letters Patent No. 3,464,808 (hereinafter referred to as the '808 or Kearns patent). The matter was tried in late November and early December 1976, and I rendered an opinion on October 7, 1977 that the patent-in-suit was valid and infringed. On December 19, 1977, I entered a judgment on liability, ordered an accounting to determine infringement damages, and enjoined defendants from infringing the '808 patent; however, I suspended the injunction pending defendants' appeal. In early 1978, the parties settled past infringement damages, costs, and attorney's fees and Usamex took a license. On March 3, 1978, a consent judgment on the issue of damages was entered, the appeal was dismissed, and the order suspending the injunction was vacated.

Almost one year later, on March 2, 1977, defendants filed a motion for relief from judgment pursuant to FRCP 60(b), essentially on the ground that newly discovered evidence revealed that their process did not

infringe plaintiff's patent. In my opinion on the patent's validity and defendants' infringement, I noted that a critical aspect of the patent claim was the reaction time within which ammonia and phosphoric acid are contacted in a jet reactor at specified temperatures, and that plaintiff's patent called for a reaction residence time of less than one second.[1] Defendants now claim they have new evidence proving the residence time of their process was greater than one second. Furthermore, in a declaratory judgment action brought pursuant to 28 U.S.C. §§ 2201, 2202, and 1338(a), and subsequently consolidated with the original case, defendants[2] claim that shortly before the opinion on liability was rendered, they modified their process to employ a 33-ft, rather than a 12-ft reactor, creating a new process with a greater than one second residence time that also does not infringe the '808 patent. Therefore, they seek a declaratory judgment of noninfringement, and $108,001.54 in damages, which is the amount of royalties they paid Swift through March 1979 under the license agreement. I instructed the parties to stipulate the undisputed facts pertinent to these matters, and to brief the disputed legal issues.

I. *Background*

The invention of the '808 patent was made by Tommy Carter Kearns, who was employed in fertilizer research and development by Swift. The patent discloses a method of producing a liquid ammonium polyphosphate fertilizer product by reacting ammonia and wet phosphoric acid

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[1] Rec.Doc.No. 226. The published opinion is *Swift Chemical Co.* v. *Usamex Fertilizers, Inc., et al.*, 197 U.S.P.Q. 10 (E.D.La. 1977).

[2] Throughout this opinion, Usamex and FFM will be referred to as defendants and Swift as plaintiff, although, of course, the parties are reversed in the declaratory judgment action. Additionally, for purposes of brevity, defendants, will be referred to simply as Usamex, rather than Usamex and FFM.

under conditions that simultaneously neutralize and molecularly dehydrate the acid. Because of its relatively high polyphosphate content, the resulting reaction product, when dissolved in water, has self-sequestering properties, *i.e.*, forms a solution wherein impurities, such as iron and aluminum salts, present in the wet process phosphoric acid are sequestered or held in solution, instead of precipitating out in the form of a gelatinous sludge that would hinder subsequent storage and handling of the liquid fertilizer product. More particularly, the method involves a direct ammoniation of orthophosphoric acid in such a manner that the exothermic heat of the reaction supplies the energy requirements to molecularly dehydrate the acid, *i.e.*, convert a substantial portion of the orthophosphates to polyphosphates [1346] without formation of appreciable quantities of highly insoluble iron tripolyphosphates and metaphosphates.[3]

Kearns filed his application for the patent-in-suit on August 8, 1965, and it was issued on September 2, 1969. The process is defined in the '808 patent claims:

> 1. A process for preparing ammonium polyphosphates having self-sequestering properties comprising: supplying a stream of ammonia to a jet reactor; supplying a stream of phosphoric acid having P_2O_5 content of between about 54% and about 68% to said jet reactor; and contacting said stream of ammonia with said stream of phosphoric acid in said reactor at temperatures of between about 450° F. and about 650° F. for a period of less than one second to form molten droplets of ammonium polyphosphate.
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> 2. The method of claim 1 wherein the droplets of molten ammonium polyphosphate are subsequently quenched.

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[3] Rec.Doc.No. 226 at 2; 197 U.S.P.Q. at 13. The basic technology involvel in the process is detailed in Rec.Doc. No. 226 at 2-9; 197 U.S. P.Q. at 13-16.

3. The process of claim 1 wherein the P_2O_5 content of acid is between about 60% and about 62%.

4. The process of claim 1 wherein at least 50% of the orthophosphate in the acid is converted to nonorthophosphate.[4]

A significant feature of the process is that the ammonia and phosphoric acid are contacted in a reactor at a temperature of from about 450° F. to 650° F. for a duration of less than one second, after which the reaction product is quenched or cooled. Such rapid reaction at a high temperature, referred to as "residence time," was found by Kearns to produce a molten ammonium polyphosphate (melt) in which a high percentage of the phosphate was in the non-ortho form, yet with little or no formation of undesirable insoluble iron and aluminum polyphosphate compounds.[5]

To provide for such extremely brief residence time at high temperature, the patent requires the use of an elongated, open-ended pipe in which to contact the ammonia and phosphoric acid, as opposed, for example, to a tank or other such reaction vessel. The patent describes the reaction pipe as a "jet" or "jet reactor," and the process is sometimes referred to as a "jet process."[6]

The accused process employed by Usamex at its plant in St. Rose, Louisiana by March 1971 involved a 12-ft reactor pipe and was described in U.S. Letters Patent No. 3,734,708 (hereinafter referred to as the '708 or Burns patent), issued May 22, 1973 to Tom V. Burns, an FFM employee.[7] By July 1975, Usamex was employing a process for manufacturing liquid fertilizer gen-

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[4] Rec.Doc.No. 226 at 5 and n.11; 197 U.S.P.Q. at 14 and n.11.

[5] Rec.Doc.No. 226 at 6; 197 U.S.P.Q. at 15.

[6] *Id.*

[7] Rec.Doc.No. 226 at 9; 197 U.S.P.Q. at 16.

erally described in U.S. Letters Patent No. 3,998,140 (hereinafter referred to as the '140 or Burns and Ortega patent).[8]

II. *Stipulated Facts*

In the development of the Kearns process, which culminated in the issuance of Swift's '808 patent, the melt was observed as being suspended in steam and exiting the reactor at a high velocity.[9] Although neither the Kearns '808 patent, the Burns '708 patent, nor the Burns and Ortega '140 patent contains a statement that the residence time was to be determined by that of the steam, it was so calculated by the respective patentees.[10]

When Usamex first began developing its process for the production of liquid ammonium polyphosphate, residence time in its 12-ft reactor was calculated on the basis of steam residence time. The actual flow characteristics in the pipe were not known exactly and were not physically assessed, and Burns never observed the steam or melt exiting the reactor. It was assumed that the melt traveled through the pipe at the same speed as the steam. Burns did not [1347] know of any way of determining residence time except by calculating steam residence time, and was unaware that radioactive material tests could be performed to determine the residence time of the steam or melt. He did not spend a great deal of time trying to find another way to calculate the residence time.[11] Calculating steam residence time was a suitable, convenient, and practical way to determine residence time; it was convenient for evaluating plant design and indicating retention time for purposes of polyphosphate conversion.[12]

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[8] Rec.Doc.No. 337, Stipulation No. 10.

[9] *Id.* No. 4.

[10] *Id.* Nos. 3, 5, 7.

[11] *Id.* No. 14.

[12] *Id.* Nos. 11, 12, 15.

In the process employed by Usamex until early October 1977, a 12-ft reactor was used, but at that time, shortly before I rendered my opinion, Usamex modified the 12-ft reactor pipe by adding 21 feet of pipe and altering the configuration. The daily production rate was increased from 600 to 700 tons. Both the 12-ft and 33-ft processes employ acid and temperatures in the ranges specified in Claim 1 of the Kearns '808 patent; achieve conversion of at least 50% of the orthophosphates of the phosphoric acid to polyphosphate form, the polyphosphates having self-sequestering properties; avoid formation of highly insoluble iron tripolyphosphates and metaphosphates; and avoid reconversion of the polyphosphates back to orthophosphate form. In both processes, the calculated steam residence time is less than one second.[13] Usamex made no efforts by test or otherwise to determine actual residence time of the liquid melt in its reactor pipes in the design and development of its 12-ft and 33-ft processes.[14]

In preparation for the 1976 trial, Everett M. Mortenson, Swift's expert, calculated the residence time of the steam in the Usamex 12-ft reactor. He did not consider the scale formed in the reactor and the volume of melt because he thought they were minor relative to the volume of steam. He testified that the melt flowed through the reactor at the same velocity as the steam; that the reaction created a froth that was carried along with a large volume of steam and gushed through the pipe at a relatively high velocity, sweeping everything out of the reactor in a jet stream or gush of fluid, steam, and melt, and discharging it in the form of droplets of melt; and that the steam would represent about 98-99% of the total volume of the material going through the Usamex reactor.[15] The residence time of melt suspended in steam in a pipe reactor is approximately that of the steam.[16] Dr.

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[13] *Id.* Nos. 11, 12, 15.

[14] *Id.* No. 13.

[15] *Id.* No. 18.

[16] *Id.* No. 16.

Graham Wallis, another Swift expert, testified that the flow regime in a reactor of peculiar geometry, such as Usamex's, must be determined by actual tests, and that calculations would give clues, but are "very dangerous" in attempting to determine the actual flow regime.[17]

The possibility that the liquid (melt) and gas (steam) phases might separate in the Usamex reactor, and that melt residence time might be greater than one second, first was considered and investigated by Usamex's experts, W. R. Mustian, Jr. and A. V. Slack, in March 1976, which was eight months prior to trial and three months prior to submission of the pre-trial order. Usamex hired both men to help prepare its defense to the infringement allegation, and they were listed as "will call" witnesses.[18] Shortly before their March 1976 tests, Mustian asked Usamex's patent counsel, Walter Gillis, whether the question of noninfringement due to a different residence time had been explored; Gillis said it had. Gillis testified that "all the information we had was that everything blew through the reactor because of the generation of the steam," and that when counsel previously asked the client whether the residence time might be increased to avoid infringement, the technical advice was that was not feasible. Gillis said that prior to spring 1976, he "never dreamed" that the steam and melt might separate in the reactor. He said the March [1348] tests and the question of residence time were under "constant discussion" up to the time of trial.[19]

Usamex admits its three March 1976 tests were crude and not conducted under normal operating conditions of the Usamex process, but contends they attempted to simulate normal operating conditions. Usamex's counsel decided to stand on the opinion of Mustian and Slack "that maybe there was phase separation confirmed, and

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[17] *Id.* No. 19.

[18] *Id.* No. 22.

[19] *Id.* No. 23.

that the tests, insofar as they were relevant to that issue, confirmed it. They certainly did not preclude us from introducing evidence of the opinion they had before the tests." Usamex did not include its theory of phase separation and longer residence time in the pre-trial order, and did not inform Swift of those theories until ten days before trial. Swift first learned of the tests when Mustian testified at trial. When Swift questioned the theories and tests on cross-examination, defendants made a tactical decision to withdraw the phase separation/residence time noninfringement defense. They did not call Slack to testify about the March 1976 tests, or Ronald Fogg, FFM technical director, to testify about a melt withdrawal he observed in Usamex's reactor in 1971 and his opinions based on it.[20]

In October 1977, I found in favor of Swift, holding the '808 patent valid, enforceable, and infringed by defendants.[21] I determined that Usamexs' phase separation/residence time defense was "obviously groundless," and its tardy assertion and subsequent withdrawal was one of the bases upon which I awarded Swift attorney's fees.[22] After entry of my judgment order of December 19, 1977, permanently enjoining defendants from further infringement, and ordering an accounting to determine damages, defendants moved to suspend the injunction pending appeal. They did not inform Swift or the Court that they had been employing the 33-ft reactor for several months. I granted the motion and suspended the injunction after defendants posted a $900,000 bond.[23] By that time, defendants had spent $600,000 for attorney's and consultant's fees and disbursements in preparation for the 1976 trial.[24]

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[20] *Id.* Nos. 24, 25, 26, 27.

[21] Rec.Doc.No. 226.

[22] *Id.* at 35; 197 U.S.P.Q. at 30-31.

[23] Rec.Doc.No. 337, Stipulation Nos. 29, 30.

[24] *Id.* No. 28.

In late 1977, Mustian, then Usamex's manager of production, prepared a 36-page report entitled "A Brief in Support of Usamex's Assumption of a Position of Non-Infringement," recommending that competent experts be consulted to confirm his phase separation/residence time arguments, and that Usamex explore with counsel ways in which to return to court to prove that neither the 12-ft nor the 33-ft process infringed Swift's patent.[25] Before the report was completed, defendants had decided to "settle friendly" in accordance with my findings, and approached Swift to obtain a license under its patent and to settle past infringement damages, costs, and attorney's fees. At the same time, Usamex intended to search for another way to contest infringement, but did not so inform Swift or the Court. Usamex took a license, and on March 3, 1978, a final judgment was entered by consent. The judgment awarded Swift damages based on Usamex's sales of the fertilizer prior to January 1, 1978. Part of the sales included fertilizer produced since October 1977 using the 33-ft reactor, although Swift did not know it, nor did it know that Usamex intended to continue using the 33-ft reactor under the license.[26]

In April and May 1978, Mustian wrote a second report entitled "A Review *In Re Swift* v. *Usamex*." One of its stated purposes was "to provide bases for determining the merits of actions to be considered leading to termination and reversal of the penalties assessed against Usamex."[27] In July 1978, defendants consulted new patent [1349] counsel for advice concerning the payment of royalties to Swift, and the attorneys advised that at least one impeccable technical expert should be consulted to prove their position of noninfringement.[28]

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[25] *Id.* Nos. 31, 32, 33.

[26] *Id.* Nos. 34, 35, 36, 37.

[27] *Id.* No. 39.

[28] *Id.* No. 40.

Drs. Dukler, Parker and Houze were contacted in October 1978 and tests were planned. In December 1978, after Dukler had made calculations of residence time, but before he had run any tests, Usamex told Swift it had a "new process" that did not infringe, and invited Swift to observe the tests; Swift declined. Tests were run in December 1978 and January 1979 to determine residence time in the 33-ft reactor. Another test was made February 24, 1979 employing a constructed 12-ft reactor. These were the first tests run since March 1976 for the purpose of determining residence time."

In January 1979, Usamex made its quarterly royalty payment covering the use of its process (in which Usamex was employing the 33-ft reactor) "under protest." It filed its motion for relief from judgment under Rule 60(b) on March 2, 1979, and its declaratory judgment action the same day. Usamex did not make its royalty payment in April 1979, contending its process using the 33-ft reactor did not infringe. After Swift threatened to terminate the license if the payment was not made, Usamex moved to enjoin termination; however, I denied the motion, and Usamex immediately made the royalty payment."

III. *Contested Facts*

The following is Usamex's description of the new test results and expert opinions drawn from them; Swift denies the validity of the tests, the conclusions drawn, and their relevancy to these matters:

(a) The melt and steam produced in the Usamex reactors separate and do not flow through the reactors at the same speed;

(b) Conversion to non-ortho polyphosphates is higher at the end of the 33-ft reactor than at any preceding test location;

" *Id.* Nos. 41, 42, 44.

" *Id.* Nos. 43, 45, 47, 48.

(c) A reaction to achieve a conversion to higher polyphosphates proceeds along the entire length of the 33-ft reactor;

(d) The melt produced in the 33-ft reactor has a range of residence times, the most probable residence time as determined by the radioactive tracer test is about 10 seconds, and as determined by the chemical tracer test, about 30 seconds.

(e) The temperature along the entire length of the 33-ft reactor during the tests performed on December 16, 1978 and January 2, 1979 was within the range of from 487° F. to 523° F.

(f) The melt flows along the bottom of both the 12-ft and 33-ft reactors in a stratified flow pattern separate from the steam, rather than being carried through the reactors as "molten droplets suspended in the steam and exiting at high rates of speed."

(h) Prior to the tests of December 16, 1978, Dr. Dukler calculated that the melt flows through the 12-ft and 33-ft reactors in a stratified flow pattern separated from the steam, that the residence time of the melt in the 33-ft reactor is about 11.7 seconds, and that the residence time of the melt at 12 feet in the 33-ft reactor is about 4.3 seconds.[21]

IV. *Rule 60(b) Motion*

FRCP 60(b) provides, in pertinent part:

> On motion and upon such terms as are just, the court may relieve a party . . . from a final judgment, order, or proceeding for the following reasons: (1) mistake, inadvertence, surprise, or excusable neglect; (2) newly discovered evidence which by due diligence could not have been discovered in time to move for a new trial under Rule 59(b); . . . (5) . . . it is no longer equitable that the judgment should have pro-

[21] Red. Doc. No. 337, Appendix.

> spective application; or (6) any other reason justifying relief from the operation of the judgment. The motion shall be made within a reasonable time, and for reasons (1), (2), . . . not more than one year after [1350] the judgment, order, or proceeding was entered and taken. A motion under this subdivision (b) does not affect the finality of a judgment or suspend its operation.

Rule 60(b) "must be equitably and liberally applied to achieve substantial justice." *Blois* v. *Friday*, 612 F.2d 938 (5th Cir. 1980). *Accord, Laguna Royalty Co.* v. *Marsh*, 350 F.2d 817, 823 (5th Cir. 1965). This rule, which allows the trial court to reopen a case, is:

> most liberally applied to default judgments; its main application is to those cases in which the true merits of a case might never be considered because of technical error, or fraud or concealment by the opposing party, or the court's inability to consider fresh evidence. [Citations omitted.] The purpose of the motion is to permit the trial judge to reconsider such matters so that he can correct obvious errors or injustices and so perhaps obviate the laborious process of appeal. Weighing against the grant of a 60(b) motion is the desirability of finality in judgments. This is particularly true where the reopening of a judgment could unfairly prejudice the opposing party. [Citation omitted]. But even without such prejudice, the desirability of orderliness and predictability in the judicial process speaks for caution in the reopening of judgments. These are matters that are addressed to the sound discretion of the trial court, and its ruling . . . will be reversed on appeal only upon a showing of abuse of discretion. [Citations omitted].

Fackelman v. *Bell*, 564 F.2d 734, 735-36 (5th Cir. 1977).

Defendants originally brought their Rule 60(b) motion under subsections (1), (2), (5), and (6); however,

in my June 6, 1979 minute entry denying Swift's motion to dismiss the Rule 60(b) motion, I concluded, and I now reaffirm, that "the thrust of the defendants' argument is that newly discovered evidence [subsection (2)] shows their process did not infringe that of the plaintiff."[22]

Defendants contend that the case should be reopened pursuant to FRCP 60(b)(1) because the testimony of Swift's expert, Mortenson, that the melt and steam flow through the 12-ft Usamex reactor at the same velocity, and that droplets of melt are discharged, was "mistaken"; however, they do not cite any case involving similar facts where the court allowed the Rule 60(b)(1) movant to characterize testimony at trial as "mistaken" where that testimony was an expert opinion based upon evidence available at the time of trial. Mortenson testified the residence time of the steam in the Usamex reactor was less than one second. Since defendants do not now contradict that measurement, but only seek to offer evidence of the residence time of the melt in the Usamex reactor, it is improper to label Mortenson's testimony as "mistaken."

Subsections (5) and (6) of Rule 60(b) also do not provide suitable avenues for reopening this case. Rule 60(b)(5) covers situations where it is no longer equitable for a judgment to have prospective application. It is a proper remedy where the court finds that due to changed conditions, the continuous effect of an injunction imposes an undue hardship on the moving party. C. Wright & A. Miller, Federal Practice and Procedure § 2863 (1973). As explained subsequently, no material operative facts have changed; therefore, the equities lie with Swift and the continuous effect of the injunction. Rule 60(b)(6) is the catchall section that is available where "any other reason justifying relief from the operation of the judgment" is present. The "other reasons" are mu-

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[22] Rec. Doc. No. 280 at 2.

tually exclusive from the five more specific grounds listed in Rule 60(b); when a reason for relief is set forth in another subsection, Rule 60(b)(6) cannot be the basis for relief. *Transit Cas. Co.* v. *Security Trust Co.*, 441 F.2d 788 (5th Cir. 1971). In this case, the ground for which relief is sought is contained in Rule 60(b)(2).

A motion for a new trial under Rule 60(b)(2) is an extraordinary motion, and the requirements of the rule must be [1351] strictly met. *Ag Pro, Inc.* v. *Sakraida*, 512 F.2d 141, 143 (5th Cir. 1975). The motion may not be granted unless: (1) the new evidence was discovered following the trial; (2) the evidence is not merely cumulative or impeaching; (3) due diligence on the part of the movant to discover the new evidence is shown or may be inferred; (4) the evidence is material; and (5) the evidence is such that a new trial would probably produce a new result. *Id.* These requirements are apropos to patent litigation. *Id.* The existence of requirements (1) and (2) does not appear to be disputed; however, I must determine whether Usamex satisfies (3), (4) and (5).

A. *Due Diligence*

The cases cited by defendants where courts found due diligence to discover new evidence simply are not very helpful, as this is the type of determination that necessarily turns on the facts in a particular case. For example, defendants rely on *Laguna Royalty Co.* v. *Marsh*, 350 F.2d 817 (5th Cir. 1965), where the court granted a Rule 60(b) motion to vacate on the ground of newly discovered evidence. *Laguna* was an action for damages to a gas well brought by owners of working interests and leaseholders against the landowner/lessor, Marsh. One of the defense theories was the sands in the well area were "bentonitic," which would decrease the porosity of the sand and prevent gas from flowing in the well, thus ending the well's productivity. Both sides offered expert testimony on the issue, but all of the experts agreed that the only way to determine conclusively whether the

sands were bentonitic was by analysis of core samples. Although a method for drilling and analyzing core samples was available prior to trial, no one had done so. The facts here, however, are not analogous. In *Laguna*, the defendant, among other things, threatened a working interest owner with trespass charges if any action was taken on the leasehold other than the removal of salvage equipment. The necessary tests were of cores obtainable during well drilling operations. The court held:

> "[T]he Trial Court could not seriously consider the contention made by the defendant to us that the plaintiffs were not diligent since they didn't drill a well to get cores upon which to refute Marsh's theory of water damage. The lawsuit was about the cost of a replacement well. It was complex enough without getting in a second one."

Laguna, *supra*, at 825. The facts in the other cases cited by defendants are also inapposite, and do not merit discussion.

In this case, Usamex's experts, as early as March 1976, attempted to validate their phase separation/melt residence time theory by conducing some rather crude tests. Other than the fact that the theory and these tests were under "constant discussion" up until trial, no efforts were made to discover a test that would validate the theory until Mustian prepared reports in December 1977 and April-May 1978 promoting the theory. Experts were not contacted until October 1978 to conduct further tests. Once contact was made, tests allegedly favorable to defendants' position were completed in less than five months. Yet Usamex concedes it was "aware of the criticality of the residence time of the phosphate melt in the reactor to a finding of infringement," although "no one was aware of a way to accurately measure this time."[11] Usamex has failed to meet its Rule 60(b)(2) burden of proving it exercised due diligence to discover its new test evidence.

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[11] Rec.Doc.No. 339 at 9.

Even if Usamex exercised due diligence, its motion for relief from judgment must be denied if it fails to prove its newly discovered evidence is material and is such that a new trial would probably produce a new result.

B. *Materiality of evidence and question whether new evidence is such that a new trial would probably produce a new result*

Since Usamex does not now reurge the invalidity of Swift's patent, the only question here is, assuming the new scientific evidence of Usamex on its 12-ft process is [1352] valid, does the process infringe the Swift patent?

In my opinion following the trial, I noted that defendants did not contest the fact that the Usamex 12-ft process is the same as that described in the Swift patent.[34] Moreover, Usamex has since stipulated that its process achieves conversion of at least 50% of the orthophosphates of the phosphoric acid to polyphosphate form, the polyphosphates having self-sequestering properties; avoids formation of highly insoluble iron tripolyphosphates and metaphosphates; and avoids reconversion of the polyphosphates back to orthophosphate form. The process employs acid and temperatures within the ranges specified in Claim 1 of the Swift patent. Furthermore, the calculated steam residence time in the Usamex reactor is less than one second.

Usamex now urges however, that even though I correctly found Swift's patent to be valid, a consideration of Usamex's new evidence would result in a determination that its process does not infringe the '808 patent, because its "residence time" is greater than one second. The new evidence is that the melt and steam produced in the Usamex reactor separate and do not flow through at the same speed, *i. e.*, the melt flows along the bottom of the reactor in a stratified flow pattern separated from

[34] *Id.* No. 226 at 9-10; 197 U.S.P.Q. at 17.

the steam, rather than being carried through the reactor as "molten droplets suspended in the steam and exiting at high rates of speed," as in the '808 process. Although the residence time of the *steam* is less than one second in the Usamex process, the residence time of the *melt* is about four seconds in the 12-ft reactor, as determined by the radioactive tracer test.

Usamex contends that the scope of the '808 patent is limited to processes in which the melt residence time is less than one second, and that the steam residence time is irrelevant. Usamex bases its construction of the patent's scope on my opinion, the patent itself, the prior art, and statements of Swift's counsel in presenting its claim to the Patent Office and in prosecuting its infringement action. It argues that the law of the case is that residence time relates to the time "the fertilizer product" or "the reaction product," *i. e.*, the molten ammonium polyphosphate, is in the reactor, not the time the steam is in the reactor.

This construction is not supported by the record. As I wrote:

> "A significant feature of the process is that the ammonia and phosphoric acid are *contacted* in a reactor at a temperature of from about 450° F. to 650° F. for duration of less than one second, after which the reaction product is quenched or cooled. *Such rapid reaction at a high temperature referred to as "residence time"* was found by Kearns to produce an ammonium polyphosphate melt in which a high percentage of the phosphate was in the non-ortho form, yet with little or no formation of undesirable insoluble iron and aluminum polyphosphate compounds."[8]

I also found that prior art reveals that the phrase in Claim 1 of the '808 patent, "contacting said stream of ammonia with said stream of phosphoric acid . . . for a

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[8] Rec.Doc. 226 at 6; 197 USPQ at 15 (emphasis added).

period of less than one second," refers "not to the speed of the molecular reaction, but to the time required to adequately mix the reactants."[36]

The real issue, then, is whether Usamex can avoid a finding of infringement by determining the residence time required to adequately mix the reactants by calculating the melt residence time rather than the steam residence time.

Although the '808 patent specifies that "[t]he reaction product as it emerges from the pipe consists of molten ammonium polyphosphate suspended in a high velocity stream of superheated steam,"[37] and it is stipulated that "[t]he residence time of melt suspended in a steam in a pipe reactor is [1353] approximately that of steam," there is nothing in the patent or elsewhere in the record that supports a finding that the less than one second residence time is determined by calculating the melt, rather than the steam, residence time.

On the contrary, it is stipulated that the residence time stated in the '808 patent is "the calculated residence time of the steam in the reactor." Additionally, although the patents describing the processes employed by Usamex—the Burns '708 patent and the Burns and Ortega '140 patent—do not explicitly state that their residence times are the calculated residence times of the steam, it is so stipulated. Usamex never physically assessed the flow characteristics of the melt and steam in the reactors used in its processes, but simply assumed that the melt traveled at the same speed as the steam. Having been taught by the '808 patent that an extremely short residence time was a factor, Usamex perfected the accused process. Calculating steam residence time was a suitable, convenient, and practical way for Usamex to determine residence time in order to evaluate its plant design.

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[36] Rec.Doc. 226 at 30; 197 USPQ at 28.

[37] Swift '808 Patent following Rec.Doc.No. 341, Col. 5, 11, 25-27.

It is particularly incongruous for Usamex to assert that the residence times specified in the Swift patent and the prior art are melt residence times, when it alleges in its Rule (60(b) motion that no one knew of a way to accurately measure melt residence time. Indeed, Usamex did not develop evidence of phase separation and a longer melt residence time until late 1978 and early 1979, when it was attempting to avoid this court's previous finding of infringement. The new evidence has had no practical use, as Usamex's processes were perfected based on calculations of steam residence time.

In deciding whether an accused device or composition infringes a valid patent, resort is had in the first instance to the words of the claim, and "[i]f accused matter falls clearly within the claim, infringement is made out and that is the end of it." *Graver Tank & Mfg. Co. v. Linde Air Products Co.*, 339 U.S. 605, 607, 70 S.Ct. 854, 855, 94 L.Ed. 1097 (1950); *Studiengesellschaft Kohle* v. *Eastman Kodak Co.*, 616 F.2d 1315 (5th Cir. 1980). "In considering literal infringement, the patent's claims must be read in connection with [the] patent's specification and its file history, and the claims of [the] patent cannot be given a construction broader than the teachings expressed in the patent." *Studiengesellschaft Kohle, supra*, at 1324. *Accord, Marvin Glass & Assoc. v. Sears, Roebuck & Co.*, 448 F.2d 60 (5th Cir. 1971). The '808 patent teaches that favorable results can be obtained in the manufacture of liquid ammonium polyphosphate when a stream of ammonia and a stream of phosphoric acid having P_2O_5 content of between about 54% and 68% are supplied to a jet reactor and contacted at temperatures of 450°—650° F. for less than one second. Because this is the process employed by Usamex, it literally infringes the '808 patent.

Even if the actual flow pattern and melt residence time in the Usamex reactor were considered in determining infringement, and it was found that there is phase separation and a more than one second melt residence time, under the judicially created doctrine of equivalents, in-

fringement still would exist. Because minor modifications in a patented invention are sufficient to put the item beyond the scope of literal infringement, courts have developed the doctrine of equivalents to protect patentees from inventions that perform "substantially the same function in substantially the same way to obtain the same result." *Graver Tank, supra,* 339 U.S. at 43, 70 S.Ct. at 13; *Studiengesellschaft Kohle, supra,* at 1324. What constitutes equivalency "must be determined against the context of the patent, the prior art, and the particular circumstances of the case." *Graver Tank, supra,* 339 U.S. at 609, 70 S.Ct. at 856. Usamex's new evidence does not change the fact that its process operates in the same manner under the same physical laws to produce the same result as the Swift patented process. At most, the new evidence would show that Swift was ignorant of the physical laws at work inside the Usamex reactor, and perhaps even inside its own reactor, and could not accurately determine the melt residence time by calculating the steam residence time. Yet the processes accomplish their [1354] objectives when the critical less than one second residence time is determined according to the calculated steam residence time. In perfecting both its 12-ft and 33-ft processes, Usamex determined residence time according to the calculated steam residence time.

Furthermore, a party cannot avoid a finding of infringement by relying on tests not known to the art at the time of the application for the patent. In an infringement action, *Raybestos-Manhattan, Inc. v. Texon, Inc.,* 268 F.2d 839 (1st Cir. 1959), the court held that a test not recognized at the date of the patent application cannot be used either to limit or extend the scope of the patent, as the patent must be interpreted in light of the skill of the art to which it pertains at the date of application. *Id.* at 842. The patent-in-suit was for a method of producing thermosetting resin impregnated cellulose fibre web sheet material. The claim element at issue called for a web, moisture content of "about 4% to 8%," which the district

court construed as an absolute limitation. The patent was silent as to any test for determining the claimed range of water content; however, the court found that the Karl Fischer test was the most accurate test, and it revealed a water content of .5 to 2.9% in the accused method. The plaintiff did not offer any evidence that the Karl Fischer test was inaccurate, and the court granted summary judgment for the defendant. On appeal, the inventor of the plaintiff's patent stated in an affidavit that in determining the amount of moisture required for his process, he relied on the "standard" desiccation (dehydration) method, and at that time, did not know of the Karl Fischer method. Reversing, the First Circuit held:

> "[T]he district court, under the circumstances presented here, was required to make a finding as to what test would be employed at the time of the patent application to determine the amount of moisture resulting from the process in question, by a person skilled in the art to which the application pertained. This is an objective standard and does not depend on the subjective intent of the inventor. Moreover, it does not cause the patent to mean one thing at the time of its issuance and another at some later date upon the discovery of a more accurate test."

Raybestos-Manhattan, supra, at 842.

Usamex cites *Helene Curtis Industries* v. *Sales Affiliates,* 233 F.2d 148 (2d Cir. 1956), in support of its position that post-application tests may be considered. There, plaintiffs sought a declaratory judgment that defendant's patent for a chemical composition suitable for permanent hair waving was invalid. The defendant's patent specified mercaptan as a waving agent, and the Second Circuit construed the patent as teaching that a mercaptan pH ceiling of 10 was a critical limitation, because with a higher pH, hair destruction or injury might occur before a satisfactory wave was obtained. At trial, plaintiff offered tests using the "direct application" method of hair

waving to show that successful waving without hair damage could be accomplished by the use of mercaptan solutions having an alkalinity in excess of pH 10; therefore, that pH level was not critical. On appeal, defendant asserted that the tests were not admissible on the issue of criticality, because at the date of his patent application, the commercial practice was to wave by the "circulation" method. The court said this contention was "fallacious in law," and continued,

> "It is, of course, true that patentable invention must be measured by the advance which it teaches over the prior art. But in determining the existence or nonexistence of such physical phenomena as demonstrate a critical advance over the prior art, we think the court is entitled to such aid as derives from any relevant technique,—even one not developed until after the invention at issue."

Helene Curtis, supra, at 154-55. Its holding however, was that defendant's argument was factually unsound, because at the date of the patent application, the "direct application" method "had substantial commercial vogue." *Id* at 155. The language in *Helene Curtis* relied on by Usamex not only is dicta, but also addresses an issue not [1355] disputed here. In this case, the validity of the Swift patent, and hence the criticality of the less than one second residence time, is not challenged. Only the manner in which the residence time is determined is disputed.

The record is clear that the test for determining residence time that would have been employed in August 1965, the time of Kearns' patent application, by a person skilled in the art, was calculation of steam residence time. It was not until March 1976 that Usamex's technical consultants for the infringement action thought of another way to calculate residence time, but did not produce a convincing test. Their idea was not revived until late 1977, when Usamex sought a way to reverse the penalties assessed against if for infringement, and the

chemical and radioactive tracer tests were not perfected until late 1978 and early 1979. In the interim, Usamex designed, built, and utilized its 33-ft reactor, alhough a test for calculatiny melt residence time still had not been performed. Usamex concedes that such tests were unknown to those working in the art: "[T]he [new] evidence . . . relates to two sampling techniques which were previously unheard of in the field of fertilizer manufacturing and which took months to develop, successfully run, and obtain complete results from."[38] Consequently, Usamex's new evidence of melt residence time is legally irrelevant, as reliance on it would "cause the patent to mean one thing at the time of its issuance and another at some later date." *Raybestos-Manhattan, supra,* at 842.

Usamex not only has failed to prove it exercised due diligence in discovering its new evidence, but the evidence, even if admitted at a new trial and found to be credible, would not produce a different result, because it is legally immaterial. Accordingly, Usamex's Rule 60(b)(2) motion for relief from judgment is DENIED.

V. Declaratory Judgment Action

Just prior to the issuance of the October 1977 opinion on the validity of the '808 patent and Usamex's infringement through use of its 12-ft reactor, Usamex constructed and began operating a 33-ft reactor. Subsequently, the parties settled the amount of damage and attorney's fees Usamex was to pay Swift under the judgment on liability, and a final consent judgment was entered March 3, 1978. The settlement included payments for periods when Usamex produced fertilizer using not only the 12-ft reactor, but also the 33-ft reactor, although Usamex did not inform Swift or the court of the existence and operation of the 33-ft reactor until many months later. The parties also entered into a license agreement, which provided that Usamex agreed to pay Swift a specified royalty for

[38] Rec.Doc.No. 269 at 7.

ammonium polyphosphate Usamex manufactured and sold under Swift's "Patent Rights," and that Swift granted Usamex a nonexclusive license to manufacture, use, and sell ammonium polyphosphate manufactured under Swift's "Patent Rights." The agreement defines "Patent Rights" as

> and process claimed and any process which by application of the Doctrine of Equivalents comes within the claims of U.S. Patent No. 3,464,808."

After Usamex obtained its new evidence of phase separation and a longer melt residence time, it sought a declaratory judgment that its process employing the 33-ft reactor does not infringe the admittedly valid '808 patent. Swift now asserts that the action should be dismissed, because it is barred by the doctrines of compromise and settlement, *res judicata*, and collateral estoppel.

A. The Settlement of Retrospective Damages

Ordinarily, compromises of disputed claims are favored by the courts. *Williams v. First Nat'l Bank*, 216 U.S. 582, 30 S.Ct. 441, 54 L.Ed. 625 (1910). Where the parties, acting in good faith, settle a controversy, the courts will enforce the compromise without regard to what the result might, or would, have been, had the parties [1356] chosen to litigate rather than settle. *Hennessy v. Bacon*, 137 U.S. 78, 11 S.Ct. 17, 34 L.Ed. 605 (1890). *Accord, J. Kahn & Co. v. Clark*, 178 F.2d 111 (5th Cir. 1949). Settlements generally are viewed as binding, final, and as conclusive of rights as a judgment. *Thomas v. State of Louisiana*, 534 F.2d 613 (5th Cir. 1976).

Nothing in the record suggests that Swift acted in any manner except in good faith in settling the amount of damages and attorney's fees owed by Usamex following the finding of infringement. If either party acted in less than good faith, it was Usamex, which did not reveal

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[11] License Agreement following Rec.Doc.No. 341.

that it had been using the 33-ft reactor during part of the period for which damages were settled. Usamex's protest that Swift failed to inquire whether it had modified its infringing process is unworthy of serious consideration. Likewise, any suggestion by Usamex that the settlement agreement is not binding due to the unequal bargaining positions of the parties is meritless. This litigation was lengthy, costly, and hard-fought. Usamex had every opportunity to acquire knowledge of the facts bearing upon the question of the validity of its defenses. *See Hennessy, supra,* 137 U.S. at 85, 11 S.Ct. at 19. That Usamex has discovered new evidence bears only on its Rule 60(b) motion, and cannot alter the fact that the parties ended their controversy by agreement. Finally, the compromise was not based on any mutual mistake of fact. During settlement negotiations, Usamex believed there was phase separation in its reactors; Swift believed there was not. Whatever the truth is, at best only one of the parties could have been mistaken about the issue. A unlateral mistake about a particular fact is insufficient to reform a contract otherwise properly entered into. *See Stevens v. Illinois Central R.R. Co.,* 234 F.2d 562, 564 & n.4 (5th Cir. 1956). Accordingly, the settlement of damages and attorney's fees will not be disturbed.

B. The License

Swift contends that the judicial determination of validity and infringement and the entry of a final judgment precludes relitigation of the question whether Usamex's process using its 33-ft reactor infringes the '808 patent. In analyzing this contention, it is important to distinguish the two doctrines concerning the preclusive effect of a prior adjudication that are embodied in the rules of *res judicata.* The first doctrine, "claim preclusion," or true *res judicata,* treats a judgment, once rendered, as the full measure of relief to be accorded between the same parties on the same "claim" or "cause of action." *Kaspar Wire Works, Inc.* v. *Leco Engineering & Mach.,* 575 F.2d 530, 535 (5th Cir. 1978).

"When the plaintiff obtains a judgment in his favor, his claim 'merges' in the judgment; he may seek no further relief on that claim in a separate action. Conversely, when a judgment is rendered for a defendant, the plaintiff's claim is extinguished; the judgment then acts as a 'bar' [Citations ommitted]. Under these rules of claim preclusion, the effect of a judgment extends to the litigation of all issues relevant to the same claim between the same parties, whether or not raised at trial."

Id. The second doctrine, "issue preclusion," or the collateral estoppel arm of *res judicata,* bars the relitigation of issues actually adjudicated and essential to the judgment in the prior litigation between the same parties. *Kaspar, supra.* Furthermore, the issue to be precluded must be identical to that involved in the prior action. *James Talcott, Inc. v. Allahatad Bank, Ltd.,* 444 F.2d 451 (5th Cir. 1971). The collateral estoppel doctrine recognizes that suits addressed to particular claims may present issues relevant to suits on other claims. *Kaspar, supra,* at 535.

Swift makes a clever argument that because the final judgment awarded damages for the Usamex process employing the 33-ft reactor, it necessarily includes a finding that the 33-ft process infringed the '808 patent; therefore, the judgment should have *res juidcata* effect. I need not decide whether this is a sound argument, because collateral estoppel is an appropriate basis upon which to rule. [1357] The key issue Usamex might be collaterally estopped from litigating is whether melt residence time of more than one second is a valid defense to an anticipated claim that the 33-ft process infringes Swift's Patent Right." The three elements necessary for the application of collateral estoppel are present. First, the defense was actually litigated in the first trial, and I found it "obviously groundless." Its tardy assertion and subsequent withdrawal were part of the basis for awarding Swift attorney's fees. That Usamex now has new evidence

to support the defense is irrelevant. All that is required for preclusion is that the issue was litigated, not that it was litigated well. Second, resolution of the issue was essential to the prior judgment. Had the defense been successful, Usamex would not have been found to be an infringer. Third, the issue in the declaratory judgment action is identical to that involved in the prior action. Aside from the availability of new evidence of melt residence time, the only difference between the 12-ft and 33-ft processes is 21 feet of pipe. The melt residence time in the 12-ft reactor allegedly was more than one second, just as it is in the 33-ft reactor, but the processes still infringe the '808 patent.[40]

Nevertheless, Usamex contends that public policy prevents the application of the two *res judicata* doctrines in the context of patent litigation, relying on *Lear, Inc. v. Adkins*, 395 U.S. 653, 89 S.Ct. 1902, 23 L.Ed.2d 610 (1969). In *Lear*, the Supreme Court abolished the doctrine of patent licensee estoppel, a doctrine rooted in contract principles, which estopped the licensee operating under a license agreement from asserting the invalidity of the patent as a defense to the licensor's contract action for nonpayment of royalties. The rationale underlying the decision was that the public has an interest in obtaining a judicial determination of the invalidity of worthless patents. The Court noted licensees may often be the only parties with enough economic incentive to challenge a patent's validity.

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[40] Usamex's allegation that conversion to nonortho phosphates is higher at the end of the 33-ft reactor than at any preceding test location, if true, would not lead to a finding of non-infringement, and therefore is immaterial. Only Claim 4 of the '808 patent refers to the amount of conversion, and it calls for "at least 50%." Any greater conversion in the Usamex process falls within this claim. Even if the greater conversion is considered an improvement of the patented process, the process remains substantially the same as the '808 process, and infringement would not be avoided. *See Tilghaman v. Proctor*, 102 U.S. 707, 26 L.Ed. 279 (1881); *Harrington Mfg. Co., Inc* v. *White*, 475 F.2d 788 (5th Cir. 1973).

Although *Lear* was concerned only with the binding force of a license agreement, its rationale has been extended by analogy to consent decrees to preclude the defense of *res judicata*." *Crane Co. v. Aeroquip Corp.*, 504 F.2d 1086 (7th Cir. 1974); *Kraly v. Nat'l Distillers and Chem. Corp.*, 502 F.2d 1366 (7th Cir. 1974); *Business Forms Finishing Serv., Inc. v. Carson*, 452 F.2d 70 (7th Cir. 1971). Nevertheless, other courts have continued to apply the rule of *Addressograph-Multigraph Corp. v. Cooper*, 156 F.2d 483 (2d Cir. 1946), to give *res judicata* effect to consent decrees that specify both patent validity and infringement, *Broadview Chem. Corp. v. Loctite Corp.*, 474 F.2d 1391 (2d Cir. 1973); *Wallace Clark & Co., Inc. v. Acheson Industries, Inc.*, 532 F.2d 846 (2d Cir. 1976); *see also Warner-Jenkinson Co. v. Allied Chem. Corp.*, 567 F.2d 184 (2d Cir. 1977); and to refuse to give it such effect where the parties' intention in entering a consent decree is not clear, *Brose v. Sears, Roebuck & Co.*, 455 F.2d 763 (5th Cir. 1972).

Although the Fifth Circuit, as other courts, has recognized that "[p]ublic policy, explicated in *Lear*, commands us not to accord monopolies by contract," *Kaspar, supra*, at 542, the concerns of *Lear* are not present in every patent dispute culminating in a consent decree. For example, in *Schlegel Mfg. Co. v. USM Corp.*, 525 F.2d 775 (6th Cir. 1975), the district court entered a consent decree declaring the patent valid and defendant to have infringed it, and permanently enjoined defendant from the unauthorized use of the patent. In a subsequent [1358] contempt action for the violation of the terms of the consent decree, the Sixth Circuit gave the decree *res judicata* effect. The court saw a significant difference between the effect of a consent decree and the doctrine of licensee estoppel abolished in *Lear*. *Lear* was not concerned with

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[1] For the remainder of this opinion, the term "*res judicata*" will be used in its broad sense, which includes collateral estoppel.

prior litigation resulting in a consent decree, but with a licensing agreement in which the licensee never was permitted to challenge the validity of the licensor's patent.

In this case, Usamex has had a full opportunity to litigate the issues. In fact, validity of the '808 patent and Usamex's infringement was not "consented to" after discovery, but were judicial determinations. The only thing consented to was the amount of damages and attorney's fees. Usamex's argument that it has not had an opportunity to litigate whether the 33-ft process infringes the patent is without merit, because there are no material differences between the 12-ft and 33-ft processes. Accordingly, Usamex's declaratory judgment action must be dismissed.

In so doing, I have considered materials outside the pleadings; therefore, I must treat Swift's briefs urging dismissal of the declaratory judgment action as a motion for summary judgment. Pursuant to FRCP 56(c), 12(b), and 43(e), I granted Usamex ten days in which to submit additional materials in opposition to summary judgment, and they were timely submitted. After carefully reviewing the record and all materials briefs submitted by counsel, I find that there are no genuine issues of material fact, and Swift is entitled to judgment as a matter of law.

APPENDIX B

646 F. 2d 1121

SWIFT CHEMICAL COMPANY,
Plaintiff-Appellee,

v.

USAMEX FERTILIZERS, INC., et al.,
Defendants-Appellants.
USAMEX FERTILIZERS, INC., et al.,
Plaintiffs-Appellants,

v.

SWIFT AGRICULTURAL CHEMICAL CORPORATION, Defendant-Appellee.

No. 80-3560.

United States Court of Appeals,
Fifth Circuit.

Unit A

April 28, 1981.

Before THORNBERRY, COLEMAN and AINSWORTH, Circuit Judges.

PER CURIAM:

Affirmed on the basis of the opinion of District Judge Morey L. Sear, 490 F.Supp. 1343 (E.D.La.1980).

AFFIRMED.